HRS DOCUMENTATION RECORD – REVIEW COVER SHEET

Site Name: Watson Johnson Landfill

EPA ID No: PAD980706824

Contact Persons

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Pathways, Components, or Threats Not Scored

Neither the soil exposure nor air migration pathways, nor the groundwater to surface water component of the surface water pathway, were scored in this Hazard Ranking System (HRS) evaluation. These pathways and component are not expected to contribute significantly to the overall site score.

HRS DOCUMENTATION RECORD

Site Name:	Watson Johnson Landfill
Date Completed:	May 2001
EPA Region:	3
Street Address of Site:	680 E. Pumping Station Rd, Richland Township, PA Note: The mailing address for the property is Quakertown, PA 18951.
County and State:	Bucks County, Pennsylvania
General Location in the State:	In the southeast portion of the state, approximately 0.75 mile north of Quakertown (Figure 1)
Topographic Maps:	Quakertown, Pennsylvania Quadrangle, 1973 **Latitude:** 40°27′36.5 N **Longitude:** 75°19′54.7 W (Ref. 30) (measured from center of site)

Hazard Ranking System (HRS) Score

Ground Water Migration Pathway	100.00
Surface Water Migration Pathway	100.00
Soil Exposure Pathway	Not Scored
Air Migration Pathway	Not Scored
Overall HRS Site Score	70.71

WORKSHEET FOR COMPUTING HRS SITE SCORE

	Pathway	S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	100.00	10000.00
2a.	Surface Water Migration Pathway: Overland Flow/Flood Migration Component (from Table 4-1, line 30)	100.00	
2b.	Surface Water Migration Pathway: Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	NS*	
2c.	Surface Water Migration Pathway Score (S_{sw}) (enter the larger of lines 2a and 2b as the pathway score)	100.00	10000.00
3.	Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	NS	—
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	NS	—
5.	Total: $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$		20000.00
6.	HRS Site Score (divide the value on line 5 by 4, then take the square root)		70.71

* NS = Not Scored

TABLE 3-1
GROUND WATER MIGRATION PATHWAY SCORESHEET

Factor Categories and Factors	Maximum Value	Value Assigned	HRS Doc. Record
Likelihood of Release to an Aquifer			
1. Observed Release	550	550	p. 29
2. Potential to Release			
2a. Containment	10	NS	
2b. Net Precipitation	10	NS	
2c. Depth to Aquifer	5	NS	
2d. Travel Time	35	NS	
2e. Potential to Release [lines 2a x (2b + 2c + 2d)]	500	NS	
3. Likelihood of Release (higher of lines 1 and 2e)	550	550	
Waste Characteristics			
4. Toxicity/Mobility Factor Value	(a)	10,000	p. 31
5. Hazardous Waste Quantity Factor Value	(a)	100	p. 32
6. Waste Characteristics Factor Category Value	100	32	p. 32
Targets			
7. Nearest Well Value	50	50	p. 35
8. Population			
8a. Level I Concentrations	(b)	11,640	p. 35
8b. Level II Concentrations	(b)	5.24	p. 35
8c. Potential Contamination	(b)	386	p. 36
8d. Population (lines 8a + 8b + 8c)	(b)	12031.24	
9. Resources	5	0	p. 36
10. Wellhead Protection Area	20	20	p. 36
11. Targets (lines 7 + 8d + 9 + 10)	(b)	12101.24	
GROUND WATER MIGRATION SCORE FOR AN AQUIFER			
12. Aquifer Score [(lines 3 x 6 x 11) / 82,500] (c)	100	100.00	
GROUND WATER MIGRATION PATHWAY SCORE			
13. Ground Water Pathway Score (S_{gw}) (highest value from line 12 for all aquifers evaluated) (c)	100	100.00	

(a) Maximum value applies to waste characteristics category
(b) Maximum value not applicable
(c) Do not round to nearest integer

TABLE 4-1
SURFACE WATER MIGRATION PATHWAY SCORESHEET

Factor Categories and Factors	Maximum Value	Value Assigned	HRS Doc. Record
Drinking Water Threat			
Likelihood of Release			
1. Observed Release	550	550	p. 40
2. Potential to Release by Overland Flow			
2a. Containment	10	NS	
2b. Runoff	25	NS	
2c. Distance to Surface Water	25	NS	
2d. Potential to Release by Overland Flow [lines 2a x (2b + 2c)]	500	NS	
3. Potential to Release by Flood			
3a. Containment (Flood)	10	NS	
3b. Flood Frequency	50	NS	
3c. Potential to Release by Flood (lines 3a x 3b)	500	NS	
4. Potential to Release (lines 2d + 3c)	500	NS	
5. Likelihood of Release (higher of lines 1 and 4)	550	550	
Waste Characteristics			
6. Toxicity/Persistence Factor Value	(a)	NS	
7. Hazardous Waste Quantity Factor Value	(a)	NS	
8. Waste Characteristics Factor Category Value	100	NS	
Targets			
9. Nearest Intake	50	0	p. 40
10. Population			
10a. Level I Concentrations	(b)	0	p. 40
10b. Level II Concentrations	(b)	0	p. 40
10c. Potential Contamination	(b)	0	p. 40
10d. Population (lines 10a + 10b + 10c)	(b)	0	
11. Resources	5	0	p. 40
12. Targets (lines 9 + 10d + 11)	(b)	0	
Drinking Water Threat Score			
13. Drinking Water Threat Score [(lines 5 x 8 x 12) / 82,500]	100	0.00	
Human Food Chain Threat			
14. Likelihood of Release (same value as line 5)	550	550	p. 40
Waste Characteristics			
15. Toxicity/Persistence/Bioaccumulation Factor Value	(a)	5.0e+08	p. 42
16. Hazardous Waste Quantity Factor Value	(a)	100	p. 43

Factor Categories and Factors	Maximum Value	Value Assigned	HRS Doc. Record
17. Waste Characteristics Factor Category Value	1000	320	p. 43
Targets			
18. Food Chain Individual	50	45	p. 45
19. Population			
19a. Level I Concentrations	(b)	0	p. 45
19b. Level II Concentrations	(b)	0.03	p. 45
19c. Potential Human Food Chain Contamination	(b)	0.00003	p. 45
19d. Population (lines 19a + 19b + 19c)	(b)	0.03003	
20. Targets (lines 18 + 19d)	(b)	45.03003	
Human Food Chain Threat Score			
21. Human Food Chain Threat Score [(lines 14 x 17 x 20) / 82,500]	100	96.06	
Environmental Threat			
22. Likelihood of Release (same value as line 5)	550	550	p. 40
Waste Characteristics			
23. Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value	(a)	5.0e+08	p. 47
24. Hazardous Waste Quantity Factor Value	(a)	100	p. 48
25. Waste Characteristics Factor Category Value	1000	320	p. 48
Targets			
26. Population			
26a. Level I Concentrations	(b)	0	p. 49
26b. Level II Concentrations	(b)	25	p. 49
26c. Potential Contamination	(b)	0.1	p. 50
26d. Sensitive Environments (lines 26a + 26b + 26c)	(b)	25.1	
27. Targets (value from line 26d)	(b)	25.1	
Environmental Threat Score			
28. Environmental Threat Score [(lines 22 x 25 x 27) / 82,500]	60	53.55	
Surface Water Overland/Flood Migration Component Score for a Watershed			
29. Watershed Score (lines 13 + 21 + 28) (c)	100	100.00	
SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE			
30. Component Score (S_{of}) (highest score from line 29 for all watersheds evaluated) (c)	100	100.00	

(a) Maximum value applies to waste characteristics category
(b) Maximum value not applicable
(c) Do not round to nearest integer

REFERENCES

No.	Description of the Reference
1.	U.S. Environmental Protection Agency (EPA). Hazard Ranking System, Final Rule, Appendix A of the National Contingency Plan, 55 Federal Register 51583, 40 Code of Federal Regulations Part 300. U.S. Government Printing Office. Washington, D.C. December 14, 1990. (137 pages)
2.	EPA. Superfund Chemical Data Matrix (SCDM). Publication 9345.1-22, EPA/540/R-961029, PB96-963510. June 1996. (26 pages)
3.	U.S. EPA. Environmental Photographic Interpretation Center (EPIC). Memorandum regarding historical aerial photograph analysis for the Watson Johnson Landfill from Terrence Slonecker, EPIC, Environmental Scientist to Peter Gold, EPA Region 3, Environmental Engineer. April 12, 1999. (6 pages)
4.	Commonwealth of Pennsylvania. Department of Health. Waste Inspection Report for the Watson Johnson Landfill, completed by Barry Passmore, Environmental Protection Specialist. July 6, 1972. (3 pages)
5.	Bucks County Department of Health. Water Quality Division. Memorandum regarding fish kill - Tohickon Creek from Albert W. Wills, Chief, Division of Sanitary Engineering, to John Daly, Jr., Chief, Enforcement and Administration Section, Water Quality Management, PA Department of Environmental Protection (formerly Department of Environmental Resources). (3 pages)
6.	Ecology and Environment, Inc. Field Investigation Team, Region III. Preliminary Assessment of Watson Johnson Landfill. October 30, 1980. (21 pages)
7.	Pennsylvania Department of Environmental Resources (PADER). Order. March 23, 1973. (4 pages)
8.	Weston. Site Inspection Report. Watson Johnson Landfill. April 29, 1999. (112 pages)
9.	Weston. Expanded Site Inspection Report. Watson Johnson Landfill. December 20, 1999. (140 pages)
10.	U.S. Geological Survey. Ground Water Atlas of the United States, Hydrologic Investigations Atlas 730-L. Segment 11. 1997. (5 pages)
11.	Pennsylvania Geological Survey, Pittsburgh Geological Society. The Geology of Pennsylvania. 1999. (4 pages)
12.	Geyer, Alan R. and J. Peter Wilshusen, Pennsylvania Geological Survey. Engineering Characteristics of the Rocks of Pennsylvania. 1982. (4 pages)
13.	Weston. PREscore 4.1 Summary Report. Watson Johnson Landfill. February 11, 2000. (137 pages)
14.	Banks Information Solutions, Inc. Water Well Report. Watson Johnson Landfill. October 3, 2000. (209 pages)

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No. Description of the Reference

15. Commonwealth of Pennsylvania. Department of Environmental Resources. Bureau of Community Environmental Control. Public Water System Sanitary Survey Report for the Quakertown Borough Water Department. September 11, 1991. (8 pages)

16. Tetra Tech EM Inc. (Tetra Tech). Population Apportion Calculation, Quakertown Borough Municipal Well System. September 27, 2000. (1 page)

17. U.S. EPA. Drew Lausch, Site Assessment Manager. Notes from meeting between Drew Lausch, EPA, Peter Gold, EPA, and Harold Koenig, Manager, Milford Township Water Authority. June 21, 1999. (2 pages)

18. Weston. Well Location Figures - Determined from Latitude/Longitude as provided in attached PADEP database. (7 pages)

19. Frost Associates. Centracts Report for Watson Johnson Landfill. August 17, 1998. (10 pages)

20. Bucks County Planning Commission. Bucks County Water Supply Plan and Wellhead Protection Study. August 1996. (17 pages)

21. Groundwater Monitoring and Remediation. "Naturally Occurring Arsenic in Sandstone Aquifer Water Supply Wells of Northeastern Wisconsin". Spring 1999. (10 pages)

22. Weston. Water Supply Summary. Not Dated. (2 pages)

23. Tetra Tech. Watson Johnson Landfill, Ground Water Migration Pathway, 4-Mile Radius Map. October 25, 2000. (1 page)

24. Tetra Tech. Watson Johnson Landfill, Surface Water Migration Pathway 15-mile Target Distance Limit. October 25, 2000. (1 page)

25. U.S. House of Representatives. Ninety-sixth Congress. Committee on Interstate and Foreign Commerce. Excerpt from Waste Disposal Site Survey. October 1979. (6 pages)

26. EPA. Fact Sheet "Using Qualified Data to Document an Observed Release and Observed Contamination." Directive 9285.7-14FS, PB95-963320, EPA 540/F-95/033. November 1996. (9 pages)

27. Weston. Record of Telephone Conversation Regarding Fisheries Between Stephen Grieco, Environmental Scientist and Mike Boyer, Biologist, PADEP, Water Quality Division. February 10, 1999. (1 page)

28. U.S. Department of the Interior. Fish and Wildlife Service. National Wetlands Inventory Maps for: Allentown East, PA (1981); Milford Square, PA (1981); Quakertown, PA (1981); Hellertown, PA (1981); Riegelville, PA-NJ (Undated); Bedminister, PA (1981). (6 pages)

29. Tetra Tech. Record of Telephone Conversation Regarding Watson Johnson Landfill Between Donna Davies, Environmental Scientist and Stephen Grieco, Environmental Scientist, Tetra Tech, Region 3. October 3, 2000. (1 page)

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30. U.S. Army Corps of Engineers. Topographic Engineering Center. Corpscon, Version 5.11.03 Program using Nadcon 2.1 Transformation for Determining Latitude and Longitude from Topographic Maps. September 1997. (2 pages)

31. Environmental Resources Management, Inc. Landfill Closure Plan, Quakertown Mine, Bucks County, Pennsylvania. November 16 1995. (3 pages)

32. Weston. Record of Telephone Conversation Regarding Ground Water Wells Between Mark Krzykalski, Environmental Scientist and Ben Grelley, Geologist, PADEP, Water Quality Division. August 18, 1999. (1 page)

33. Weston. Watson Johnson Landfill Site Files. Residential Well Sample ID. September 1998. (1 page)

34. Weston. Watson Johnson Landfill Site Files. Home Well Surveys. September 1998. (12 pages)

35. Weston. Excerpts from Logbook for Watson Johnson Landfill ESI, SATA03A01295. May 19, 1999. (4 pages)

36. Weston. Record of Telephone Conversation Regarding Watson Johnson Landfill Liner Between Stephen Grieco, Environmental Scientist and Peter Gold, Environmental Engineer, U.S. EPA, Region 3. March 8, 1999. (1 page)

37. Tuck Moorshead. Project Status Report, Watson Johnson. November 29, 1972. (2 pages)

38. Tetra Tech. Record of Telephone Conversation Regarding Size of Tohickon Creek Between Donna Davies, Environmental Scientist and Stephen Grieco, Tetra Tech Environmental Scientist. October 9, 2000. (1 page)

39. EPA. EPA Environmental Assessment Sourcebook. 1996. (4 pages)

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41. TIER DE, Inc. Closure Report for the Watson Johnson Landfill. July 2000. (266 pages)

42. EPA. Memorandum Regarding Watson Johnson Landfill from Bernice Pasquini, Geologist to Robert D. Lausch, Site Assessment Manager. February 13, 2001. (4 pages)

43. Tetra Tech. Record of Telephone Conversation Regarding Quakertown Borough Municipal Wells 10 and 17 Between Donna Davies, Environmental Scientist and Mike Brazezicki, Superintendent, Quakertown Borough Water Authority. January 17, 2001. (1 page)

ACRONYMS AND ABBREVIATIONS

App.	Appendix
CLP	Contract Laboratory Program
EPA	U.S. Environmental Protection Agency
ESI	Expanded Site Inspection
ft	Feet
ft^2	Square feet
GW	Ground water
HRS	Hazard Ranking System
HWQ	Hazardous Waste Quantity
MCL	Maximum Contaminant Level
mg/kg	Milligram per kilogram
NA	Not applicable
NL	Not listed
NS	Not scored
OR	Observed release
PADER	Pennsylvania Department of Environmental Resources (former name)
PADEP	Pennsylvania Department of Environmental Protection (current name)
PCBs	Polychlorinated byphenols
PCE	Tetrachloroethene (perchloroethene) / tetrachloroethylene
PPE	Probable point of entry
SATA	Site Assessment Technical Assistance
SCDM	Superfund Chemical Data Matrix
Sect.	Section
SI	Site Inspection
SWOF	Surface Water Overland Flow
TCE	Trichloroethene / trichloroethylene
TDL	Target distance limit
µg/kg	Microgram per kilogram
µg/L	Microgram per liter

Figure 1 - Site Location Map

A copy of the Site Location Map, Figure 1, is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

Figure 2 - Site Sketch/Monitoring Well Location Map

A copy of the Site Sketch/Monitoring Well Location Map, Figure 2, is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

INTRODUCTION

The Watson Johnson Landfill site consists of a 32.1-acre inactive landfill located approximately 0.75 mile north of Quakertown in Richland Township, Bucks County, Pennsylvania (Figures 1 and 2). The landfill accepted waste from approximately 1936 until 1973 from all of Quakertown Borough, portions of Perkasie and Sellersville Boroughs, and other Upper Bucks County areas (Ref. 3, p. 2; Ref. 5, p. 2; Ref. 6, p. 2). The exact types and quantities of wastes accepted at the landfill is not known. The landfill was never permitted to accept waste (Ref. 3, p. 2). Evidence of hazardous substances being disposed at the site is provided from several sources. The Waste Disposal Site Survey (Eckhardt Survey) that was completed by the U.S. Congress in 1979 indicated that W.R. Grace & Company disposed of a total of 3,200 tons of waste at the Watson Johnson Landfill from their Quakertown chemical facility from 1965 through 1968. According to this report this waste was composed of various organic and inorganic compounds, resins, and elastomers (Ref. 25). Evidence of hazardous substances deposited at the site was also provided during the drilling of monitoring wells at the landfill. During drilling activities a drum containing an unknown substance was discovered in the landfill 6 - 12 inches below the surface. Analytical results of the drum contents revealed 19 parts per million (ppm) of tetrachloroethene (Ref. 13, p. 5).

During the time the landfill was active several ponds of leachate were located along the southern and western edge of the landfill (Ref. 4; Ref. 5, p. 2). In 1972 the owner of the landfill, Watson Johnson, pumped the leachate from one of these lagoons into a wetland adjacent to the landfill where it flowed into Tohickon Creek. This caused a significant fish kill (several hundred fish or more) to occur in the Tohickon Creek (Ref. 4; Ref. 5, p. 1). The fish kill took place on July 2, 1972. Investigations by the Bucks County Health Department and the Pennsylvania Fish Commission determined that the pumping of leachate from the Watson Johnson Landfill was the cause of the fish kill (Ref. 5, p. 1). The Pennsylvania Department of Environmental Resources (PADER) issued an order to the Watson Johnson Landfill in 1973. This order determined that the site was an illegal solid waste disposal site that allowed leachate to discharge into surface waters of the Commonwealth; therefore, the site was ordered to immediately cease all operation (Ref. 7).

The U.S. Environmental Protection Agency (EPA) Region 3's Site Assessment Technical Assistance (SATA) team conducted field investigations at the site from 1998 through 1999. SATA collected samples from on-site soils, adjacent wetlands, and Tohickon Creek, and installed and sampled ground water monitoring wells as well as local residential and Quakertown Borough municipal wells (Ref. 8; Ref. 9). Hazardous substances detected in the soils of the landfill include volatile organic compounds, semi-volatile organic compounds, polychlorinated biphenols (PCBs), and metals (Ref. 8, App. 1, Sect. 3; Ref. 13, p. 5; Ref. 45, pp. 1 through 3 and D-2 through D-11). Tetrachloroethene (PCE; aka perchloroethene) and trichloroethene (TCE) were detected in an on-site monitoring well and a Quakertown Borough Municipal Well (Ref. 9, App. 1, pp. 9 and 52). Elevated metals and PCB were detected in sediment samples collected from an adjacent wetland and an elevated level of mercury was detected downstream of the site in Tohickon Creek (Ref. 8, App. 1, Sect. 4; Ref. 9, pp. 13).

Immediately to the west of the Watson Johnson Landfill is a property which was formerly mined and then later used for waste tile disposal by the American Olean Tile company (Ref. 31, p. 2). This adjacent property may therefore be contaminated with metals and/or other hazardous substances. In this Hazard Ranking System (HRS) scoring for the Watson Johnson Landfill site, however, all of the hazardous substances documented to be in ground water and surface waters were detected in elevated levels in the soils of the Watson Johnson Landfill. Therefore, the releases evaluated in this HRS scoring are at least partially attributable to the Watson Johnson Landfill site.

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 1

Source Description: Landfill

Source Type: Landfill

Source 1 is a 32.1 acre landfill (Ref. 3, p. 2). From approximately 1936 until 1973, this unlined, unpermitted landfill accepted wastes from all of Quakertown Borough, portions of Perkasie and Sellersville Boroughs and other Upper Bucks County areas (Ref. 5, p. 2; Ref. 6, p. 2; Ref. 36; Ref. 37). The exact types and quantities of wastes accepted at the landfill is not known. The Waste Disposal Site Survey (Eckhardt Survey) that was completed by the U.S. Congress in 1979 indicated that the W.R. Grace & Company disposed of a total of 3,200 tons of waste at the Watson Johnson Landfill from their Quakertown chemical facility from 1965 through 1968. According to this report this waste was composed of various organic and inorganic compounds, resins, and elastomers (Ref. 25). During the drilling of monitoring wells at the landfill a drum containing product was discovered 6 - 12 inches below the surface. Analytical results of the drum contents revealed 19 parts per million (ppm) of PCE (Ref. 13, p. 5). Subsequent analytical results from soil samples collected in the area of the drum revealed up to 12 µg/kg of PCE (Ref. 45, pp. 1 through 3 and D-2 through D-11). During the time the landfill was active several ponds of leachate were located along the southern and western edge of the landfill (Ref. 4; Ref. 5, p. 2). In 1972 the owner of the landfill, Watson Johnson, pumped the leachate from one of these lagoons into a swamp adjacent to the landfill where it flowed by gravity into a tributary of Tohickon Creek. This caused a significant fish kill (several hundred fish or more) to occur in the Tohickon Creek (Ref. 4; Ref. 5, p. 1). The fish kill took place on July 2, 1972. Investigations by the Bucks County Health Department and the PA Fish Commission determined the pumping of leachate from the Watson Johnson Landfill was the cause of the fish kill (Ref. 5, p. 1).

Source Location:

The source is located south of East Pumping Station Road and west of Richlandtown Pike (PA Route 212) in Richland Township, Bucks County, Pennsylvania. See Figures 1 and 2.

Containment:

Release to Ground Water: A release of hazardous substances to ground water is established, as documented in Section 3.1.1 of this documentation record, based on the existence of monitoring and residential wells contaminated with hazardous substances detected at the source; therefore, a containment factor value of 10 was assigned (Ref. 1, Table 3-2, p. 51596).

Release Via Overland Migration and/or Flood: A release to surface water is established, as documented in Section 4.1.2.1.1 of this documentation record, based on the existence of contaminated surface water and sediment samples downstream of the site. Further evidence of releases from the site is documented by the March 23, 1973 PADER order, which determined that the Watson Johnson Landfill allowed leachate to discharge into surface waters of the Commonwealth (Ref. 7, p.2). Because a release

of hazardous substances to surface water is documented to have occurred from the site, a containment factor value of 10 was assigned (Ref. 1, Table 4-2, p. 51609).

Gas Release to Air: The air migration pathway was not scored.

Particulate Release to Air: The air migration pathway was not scored.

2.4.1 Hazardous Substances

Evidence that hazardous substances were disposed of at the landfill is provided by the results of the Eckhardt survey that documents 3,200 tons of chemical waste was disposed of at the landfill. The generator of this waste stated that it was composed of various organic and inorganic compounds, resins, and elastomers (Ref. 25). Further evidence of hazardous substances disposed of the landfill is the drum containing PCE that was discovered at the landfill during the drilling of monitoring wells (Ref. 13, p. 5). As shown in the table below, evidence is further provided by the laboratory results of surface and subsurface soil samples that were collected from the source during the site inspection (SI) and ESI completed by EPA Region 3's SATA team (Ref. 8, App. 2, Figure 2; Ref. 9, p. 4). The samples collected were analyzed according to EPA Contract Laboratory Program (CLP) protocols (Ref. 8, p. 1). Soil samples are compared to the following background samples: WJSB-01A, WJSB-01B, and SS-01. In lieu of the Sample Quantitation Limit, the Contract Required Quantitation Limit (CRQL) (for organics) or the Contract Required Dectection Limit (CRDL) (for inorganics) is given (Ref. 1, p. 51589, Table 2-3).

ORGANICS					
Hazardous Substance	Sample/ Evidence	Concentrations (mg/kg)			Reference
		Sample	Background	CRQL	
Acetone	WJSB-06A	33.7	<5	5	8, App. 1, Sect. 3, pp. 4 and 7
	WJSB-07A	54.9	<5	5	8, App. 1, Sect. 3, pp. 4 and 7
	WJSB-08A	41.1	<5	5	8, App. 1, Sect. 3, pp. 4 and 10
	WJSB-05B	104	<5	5	8, App. 1, Sect. 3, p. 10
	WJSB-06B	46.7	<5	5	8, App. 1, Sect. 3, p. 10
	WJSB-07B	131	<5	5	8, App. 1, Sect. 3, p. 10
Acenaphthene	WJSB-04A	43	<0.33	0.33	8, App. 1, Sect. 3, p. 12
	WJSB-06A	20.2	<0.33	0.33	8, App. 1, Sect. 3, pp. 12
	WJSB-06B	8.58	<0.33	0.33	8, App. 1, Sect. 3, p. 16
Aniline	WJSB-04A	25.9	<0.33	0.33	8, App. 1, Sect. 3, p. 12
Anthracene	WJSB-06A	40.1	<0.33	0.33	8, App. 1, Sect. 3, pp. 12 and 14
	WJSB-06B	16.6	<0.33	0.33	8, App. 1, Sect. 3, p. 16
Aroclor-1242	WJSB-07A	7.3	<0.033	0.033	8, App. 1, Sect. 3, pp. 18,19
	WJSB-06B	1.8	<0.033	0.033	8, App. 1, Sect. 3, p. 20
	WJSB-07B	6.4	<0.033	0.033	8, App. 1, Sect. 3, p. 20
Aroclor-1248	WJSB-05A	3.6	<0.033	0.033	8, App. 1, Sect. 3, pp. 18,19
	WJSB-06A	1.9	<0.033	0.033	8, App. 1, Sect. 3, pp. 18, 19
	WJSB-05B	5.9	<0.033	0.033	8, App. 1, Sect. 3, p. 20
Aroclor-1254	WJSB-02B	0.31	<0.033	0.033	8, App. 1, Sect. 3, p. 20
	WSSCP-01	0.2	<0.033	0.033	9, App. 1, p. 42
Aroclor-1260	WJSB-05B	0.77	<0.033	0.033	8, App. 1, Sect. 3, p. 20
	WJSB-06B	0.21	<0.033	0.033	8, App. 1, Sect. 3, p. 20
	WJSB-07B	0.21	<0.033	0.033	8, App. 1, Sect. 3, p. 20
Benzo(a)anthracene	WJSB-04A	14	<0.33	0.33	8, App. 1, Sect. 3, p. 12

Source #1: Hazardous Substances

Hazardous Substance	Sample/ Evidence	Concentrations (mg/kg)			Reference
		Sample	Background	CRQL	
	WJSB-06A	48.1	<0.33	0.33	8, App. 1, Sect. 3, pp. 12 ,14
Benzo(a)anthracene	WJSB-05B	2.64	<0.33	0.33	8, App. 1, Sect. 3, p. 16
	WJSB-06B	21.8	<0.33	0.33	8, App. 1, Sect. 3, p. 16
Benzo(a)pyrene	WJSB-04A	6.44	<0.33	0.33	8, App. 1, Sect. 3, p. 12
	WJSB-06A	40.1	<0.33	0.33	8, App. 1, Sect. 3, pp. 12 , 14
	WJSB-06B	21.7	<0.33	0.33	8, App. 1, Sect. 3, p. 16
	WSSCP-02	1.1	<0.33	0.33	9, App. 1, p. 41
Benzo(b)fluoranthene	WJSB-04A	9.3	<0.33	0.33	8, App. 1, Sect. 3, p. 12
	WJSB-06A	35.6	<0.33	0.33	8, App. 1, Sect. 3, pp. 12 ,14
	WJSB-06B	13.8	<0.33	0.33	8, App. 1, Sect. 3, p. 16
	WSSCP-02	2.6	<0.33	0.33	9, App. 1, p. 41
Benzo(g,h,i)perylene	WJSB-04A	3.33	<0.33	0.33	8, App. 1, Sect. 3, p. 12
	WJSB-06A	18.5	<0.33	0.33	8, App. 1, Sect. 3, pp. 12,14
	WJSB-06B	8.07	<0.33	0.33	8, App. 1, Sect. 3, p. 16
	WSSCP-02	0.72	<0.33	0.33	9, App. 1, p. 41
Benzo(k)fluoranthene	WJSB-06A	27.8	<0.33	0.33	8, App. 1, Sect. 3, pp. 12, 14
Bromobenzene	WJSB-06A	5.1	<5	5	8, App. 1, Sect. 3, pp. 4 and 7
Butylbenzene(n)	WJSB-02A	9.6	<5	5	8, App. 1, Sect. 3, p. 4
	WJSB-05A	49.9	<5	5	8, App. 1, Sect. 3, pp. 4 and 7
	WJSB-02B	6.2	<5	5	8, App. 1, Sect. 3, pp. 10, 12
	WJSB-05B	15.5	<5	5	8, App. 1, Sect. 3, pp. 10, 12
	WJSB-06B	13.2	<5	5	8, App. 1, Sect. 3, pp. 10, 12
Bis(2-ethylhexyl) phthalate	WJSB-03A	2.69	<0.33	0.33	8, App. 1, Sect. 3, p. 12
	WJSB-05A	156	<0.33	0.33	8, App. 1, Sect. 3, pp. 12, 14
	WJSB-07A	284	<0.33	0.33	8, App. 1, Sect. 3, pp. 12, 14
Butylbenzene(sec-)	WJSB-03A	5.5	<5	5	8, App. 1, Sect. 3, p. 4
	WJSB-05A	41.3	<5	5	8, App. 1, Sect. 3, pp. 4 and 7
	WJSB-05B	10.8	<5	5	8, App. 1, Sect. 3, pp. 10 and 12
Carbazole	WJSB-06A	30	<0.33	0.33	8, App. 1, Sect. 3, pp. 12 and 14
	WJSB-06B	11.8	<0.33	0.33	8, App. 1, Sect. 3, p. 16
Chlorobenzene	WJSB-02A	36.8	<5	5	8, App. 1, Sect. 3, p. 3
	WJSB-03A	6.7	<5	5	8, App. 1, Sect. 3, p. 3
	WJSB-05A	23.3	<5	5	8, App. 1, Sect. 3, pp. 4 and 7
	WJSB-06A	5.4	<5	5	8, App. 1, Sect. 3, pp. 4 and 7
	WJSB-02B	40.7	<5	5	8, App. 1, Sect. 3, pp. 10 and 12
	WJSB-07B	19.4	<5	5	8, App. 1, Sect. 3, pp. 10 and 12
Chrysene	WJSB-04A	18	<0.33	0.33	8, App. 1, Sect. 3, p. 12
	WJSB-06A	47.2	<0.33	0.33	8, App. 1, Sect. 3, pp. 12 and 14

Source #1: Hazardous Substances

Hazardous Substance	Sample/ Evidence	Concentrations (mg/kg)			Reference
		Sample	Background	CRQL	
	WJSB-05B	4.45	<0.33	0.33	8, App. 1, Sect. 3, p. 16
Chrysene	WJSB-06B	20.4	<0.33	0.33	8, App. 1, Sect. 3, p. 16
	WSSCP-02	1.4	<0.33	0.33	9, App. 1, p. 41
DDD(4,4')	WJSB-05A	0.28	<0.033	0.33	8, App. 1, Sect. 3, pp. 18, 19
Dibenzo(a,h)anthracene	WJSB-04A	1.87	<0.33	0.33	8, App. 1, Sect. 3, p. 12
	WJSB-06A	12	<0.33	0.33	8, App. 1, Sect. 3, pp. 12, 14
Dibenzofuran	WJSB-04A	21.5	<0.33	0.33	8, App. 1, Sect. 3, p. 12
	WJSB-06A	13.6	<0.33	0.33	8, App. 1, Sect. 3, pp. 12 and 14
	WJSB-06B	6.31	<0.33	0.33	8, App. 1, Sect. 3, p. 16
Dichlorobenzene(1,2-)	WJSB-02A	7.3	<5	5	8, App. 1, Sect. 3, p. 3
	WJSB-02B	8.8	<5	5	8, App. 1, Sect. 3, pp. 10 and 12
	WJSB-07B	5.4	<5	5	8, App. 1, Sect. 3, pp. 10 and 12
Dichlorobenzene(1,4-)	WJSB-02A	6.7	<5	5	8, App. 1, Sect. 3, p. 3
	WJSB-03A	7.1	<5	5	8, App. 1, Sect. 3, p. 4
	WJSB-05A	19.8	<5	5	8, App. 1, Sect. 3, pp. 4 and 7
	WJSB-06A	7.4	<5	5	8, App. 1, Sect. 3, pp. 4 and 7
	WJSB-02B	9.7	<5	5	8, App. 1, Sect. 3, pp. 10 and 12
	WJSB-05B	7	<5	5	8, App. 1, Sect. 3, pp. 10 and 12
	WJSB-06B	5.3	<5	5	8, App. 1, Sect. 3, pp. 10 and 12
	WJSB-07B	16.1	<5	5	8, App. 1, Sect. 3, pp. 10 and 12
Dichlorodifluoro-methane	WJSB-06A	130	<5	5	8, App. 1, Sect. 3, pp. 4 and 7
	WJSB-06B	28.6	<5	5	8, App. 1, Sect. 3, pp. 10 and 12
Di-n-butylphthalate	WJSB-05A	27.4	<0.33	0.33	8, App. 1, Sect. 3, pp. 12 and 14
Ethylbenzene	WJSB-02A	7.2	<5	5	8, App. 1, Sect. 3, pp. 4 and 5
	WJSB-04A	7.1	<5	5	8, App. 1, Sect. 3, pp. 4 and 5
	WJSB-06B	6.8	<5	5	8, App. 1, Sect. 3, pp. 11 and 12
Fluoranthene	WJSB-04A	57.7	<0.33	0.33	8, App. 1, Sect. 3, p. 12
	WJSB-06A	130	<0.33	0.33	8, App. 1, Sect. 3, pp. 12 and 14
	WJSB-02B	1.42	<0.33	0.33	8, App. 1, Sect. 3, p. 16
	WJSB-05B	3.8	<0.33	0.33	8, App. 1, Sect. 3, p. 16
	WJSB-06B	55.6	<0.33	0.33	8, App. 1, Sect. 3, p. 16
	WSSCP-02	2.7	<0.33	0.33	9, App. 1, p. 41
Fluorene	WJSB-04A	34.7	<0.33	0.33	8, App. 1, Sect. 3, p. 12
	WJSB-06A	21.1	<0.33	0.33	8, App. 1, Sect. 3, pp. 12 and.14
	WJSB-06B	9.27	<0.33	0.33	8, App. 1, Sect. 3, pp. 16 and 17
Indeno(1,2,3-cd)pyrene	WJSB-04A	4.02	<0.33	0.33	8, App. 1, Sect. 3, pp. 12 and 13
	WJSB-06A	24.3	<0.33	0.33	8, App. 1, Sect. 3, pp. 12 and 15
	WJSB-05B	2.95	<0.33	0.33	8, App. 1, Sect. 3, pp. 16 and 17

Source #1: Hazardous Substances

Hazardous Substance	Sample/ Evidence	Concentrations (mg/kg)			Reference
		Sample	Background	CRQL	
	WJSB-06B	9.94	<0.33	0.33	8, App. 1, Sect. 3, pp. 16 and 17
Indeno(1,2,3-cd)pyrene	WSSCP-02	0.85	<0.33	0.33	9, App. 1, p. 41
Isopropylbenzene	WJSB-02A	6.7	<5	5	8, App. 1, Sect. 3, p. 5
	WJSB-03A	8.3	<5	5	8, App. 1, Sect. 3, p. 5
	WJSB-02B	7.6	<5	5	8, App. 1, Sect. 3, p. 11
	WJSB-05B	10.9	<5	5	8, App. 1, Sect. 3, p. 11
	WJSB-06B	12.1	<5	5	8, App. 1, Sect. 3, p. 11
	WJSB-07B	5.2	<5	5	8, App. 1, Sect. 3, p. 11
	WJSB-05A	18.9	<5	5	8, App. 1, Sect. 3, pp. 5 and 8
Isopropyltoluene(p-)	WJSB-05A	12.1	<5	5	8, App. 1, Sect. 3, pp. 5 and 8
	WJSB-06B	9.8	<5	5	8, App. 1, Sect. 3, p. 11
Methylene Chloride	WJSB-08A	6.2	<5	5	8, App. 1, Sect. 3, pp. 5 and 8
	WJSB-05B	7.1	<5	5	8, App. 1, Sect. 3, p. 11
Methylnaphthalene(2-)	WJSB-04A	27.6	<0.33	0.33	8, App. 1, Sect. 3, pp. 11 and 13
	WJSB-06A	4.98	<0.33	0.33	8, App. 1, Sect. 3, pp. 11 and 15
	WJSB-06B	3.79	<0.33	0.33	8, App. 1, Sect. 3, pp. 11 and 17
Naphthalene	WJSB-02A	106	<5	5	8, App. 1, Sect. 3, p. 5
	WJSB-03A	58.9	<5	5	8, App. 1, Sect. 3, p. 5
	WJSB-04A	69600	<5	5	8, App. 1, Sect. 3, p. 5
	WJSB-05A	41	<5	5	8, App. 1, Sect. 3, pp. 5 and 8
	WJSB-06A	151	<5	5	8, App. 1, Sect. 3, pp. 5 and.8
	WJSB-07A	15	<5	5	8, App. 1, Sect. 3, pp. 5 and 8
	WJSB-02B	27.9	<5	5	8, App. 1, Sect. 3, p. 11
	WJSB-05B	13.8	<5	5	8, App. 1, Sect. 3, p. 11
	WJSB-06B	49.5	<5	5	8, App. 1, Sect. 3, p. 11
	WJSB-07B	12.8	<5	5	8, App. 1, Sect. 3, p. 11
	WJSB-04A	64	<0.33	0.33	8, App. 1, Sect. 3, pp. 5 and 13
	WJSB-05A	1.22	<0.33	0.33	8, App. 1, Sect. 3, pp. 5 and 15
	WJSB-06A	4.4	<0.33	0.33	8, App. 1, Sect. 3, p. 15
	WJSB-06B	6.04	<0.33	0.33	8, App. 1, Sect. 3, pp. 11 and 17
Phenanthrene	WJSB-04A	106	<0.33	0.33	8, App. 1, Sect. 3, pp. 5 and 13
	WJSB-06A	117	<0.33	0.33	8, App. 1, Sect. 3, pp. 5 and 15
	WJSB-05B	3.06	<0.33	0.33	8, App. 1, Sect. 3, pp. 11 and 17
	WJSB-06B	51.7	<0.33	0.33	8, App. 1, Sect. 3, pp. 11 and 17
	WSSCP-02	1.9	<0.33	0.33	9, App. 1, p. 41
Phenol	WJSB-02B	1.61	<0.33	0.33	8, App. 1, Sect. 3, pp. 11 and 17
Propylbenzene(n-)	WJSB-03A	15.3	<5	5	8, App. 1, Sect. 3, p. 5
	WJSB-02B	6.7	<5	5	8, App. 1, Sect. 3, p. 11

Source #1: Hazardous Substances

Hazardous Substance	Sample/ Evidence	Concentrations (mg/kg)			Reference
		Sample	Background	CRQL	
	WJSB-05B	19.9	<5	5	8, App. 1, Sect. 3, p. 11
Propylbenzene(n-)	WJSB-06B	21.7	<5	5	8, App. 1, Sect. 3, p. 11
Pyrene	WJSB-03A	0.67	<0.33	0.33	8, App. 1, Sect. 3, pp. 5 and 13
	WJSB-04A	46.2	<0.33	0.33	8, App. 1, Sect. 3, pp. 5 and 13
	WJSB-06A	99.4	<0.33	0.33	8, App. 1, Sect. 3, pp. 5 and 15
	WJSB-02B	2.4	<0.33	0.33	8, App. 1, Sect. 3, pp. 11 and 17
	WJSB-05B	7.94	<0.33	0.33	8, App. 1, Sect. 3, pp. 11 and .17
	WJSB-06B	44.2	<0.33	0.33	8, App. 1, Sect. 3, p. 17
	WSSCP-02	2.2	<0.33	0.33	9, App. 1, p. 41
Tetrachloroethene	Drum Sample	19	NA	NA	13, p. 5
Trimethylbenzene (1,2,4-)	WJSB-02A	31.2	<5	5	8, App. 1, Sect. 3, pp. 5 and 6
	WJSB-03A	115	<5	5	8, App. 1, Sect. 3, pp. 5 and 6
	WJSB-04A	47	<5	5	8, App. 1, Sect. 3, pp. 5 and 6
	WJSB-02B	37.2	<5	5	8, App. 1, Sect. 3, p. 11
	WJSB-05B	92.1	<5	5	8, App. 1, Sect. 3, p. 11
	WJSB-06B	137	<5	5	8, App. 1, Sect. 3, p. 11
	WJSB-07B	7.6	<5	5	8, App. 1, Sect. 3, p. 11
Xylene (m,p)	WJSB-02A	17.3	<5	5	8, App. 1, Sect. 3, p. 5
	WJSB-03A	12.4	<5	5	8, App. 1, Sect. 3, p. 5
	WJSB-04A	15.2	<5	5	8, App. 1, Sect. 3, p. 5
	WJSB-05A	9	<5	5	8, App. 1, Sect. 3, pp. 5 and 8
	WJSB-02B	16.8	<5	5	8, App. 1, Sect. 3, p. 11
	WJSB-05B	10	<5	5	8, App. 1, Sect. 3, p. 11
	WJSB-06B	50.6	<5	5	8, App. 1, Sect. 3, p. 11
Xylene (o)	WJSB-04A	11.4	<5	5	8, App. 1, Sect. 3, p. 5
	WJSB-06B	21.5	<5	5	8, App. 1, Sect. 3, p. 11

INORGANICS

Hazardous Substance	Sample/ Evidence	Concentrations (mg/kg)			Reference
		Sample	Background	CRDL	
Arsenic	WJSB-06B	12.5	2.7	2	8, App. 1, Sect. 3, p. 3
	WJSB-07B	8.7	2.7	2	8, App. 1, Sect. 3, p. 3
Chromium	WJSB-06B	97.9	31.9	2	8, App. 1, Sect. 3, p. 3
	WJSB-07B	107	31.9	2	8, App. 1, Sect. 3, p. 3
	WJSB-07A	201	31	2	8, App. 1, Sect. 3, pp. 1 and 2
Copper	WJSB-02B	76	8.7	5	8, App. 1, Sect. 3, p. 3
	WJSB-05B	162	8.7	5	8, App. 1, Sect. 3, p. 3
	WJSB-06B	200	8.7	5	8, App. 1, Sect. 3, pp. 1 and 2
	WJSB-05A	1890	11.2	5	8, App. 1, Sect. 3, pp. 1 and 2

Source #1: Hazardous Substances

Hazardous Substance	Sample/ Evidence	Concentrations (mg/kg)			Reference
		Sample	Background	CRDL	
	WJSB-07A	624	11.2	5	8, App. 1, Sect. 3, pp. 1 and 2
Copper	WJSB-07B	243	8.7	5	8, App. 1, Sect. 3, p. 3
Lead	WJSB-03A	389	<0.6	0.6	8, App. 1, Sect. 3, p. 1
	WJSB-04A	73.7	<0.6	0.6	8, App. 1, Sect. 3, p. 1
	WJSB-05A	320	<0.6	0.6	8, App. 1, Sect. 3, pp. 1 and 2
	WJSB-06A	173	<0.6	0.6	8, App. 1, Sect. 3, pp. 1 and 2
	WJSB-07A	2890	<0.6	0.6	8, App. 1, Sect. 3, pp. 1 and 2
	WJSB-08A	11.2	<0.6	0.6	8, App. 1, Sect. 3, pp. 1 and 2
Manganese	WJSB-03A	836	101	3	8, App. 1, Sect. 3, p. 1
	WJSB-04A	785	101	3	8, App. 1, Sect. 3, p. 1
	WJSB-06A	10400	101	3	8, App. 1, Sect. 3, pp. 1 and 2
	WJSB-07A	2230	101	3	8, App. 1, Sect. 3, pp. 1 and 2
	WJSB-02B	962	238	3	8, App. 1, Sect. 3, p. 3
	WJSB-06B	1060	238	3	8, App. 1, Sect. 3, p. 3
	WJSB-07B	805	238	3	8, App. 1, Sect. 3, p. 3
Mercury	WJSB-07A	3.1	<0.2	0.2	8, App. 1, Sect. 3, pp. 1 and 2
	WJSB-02B	0.3	<0.2	0.2	8, App. 1, Sect. 3, p. 3
	WJSB-05B	1.2	<0.2	0.2	8, App. 1, Sect. 3, p. 3
	WJSB-06B	0.2	<0.2	0.2	8, App. 1, Sect. 3, p. 3
	WJSB-07B	0.9	<0.2	0.2	8, App. 1, Sect. 3, p. 3
Nickel	WJSB-06A	777	20.8	8	8, App. 1, Sect. 3, pp. 1 and 2
	WJSB-07A	625	20.8	8	8, App. 1, Sect. 3, pp. 1 and 2
	WJSB-06B	103	30.2	8	8, App. 1, Sect. 3, p. 3
	WJSB-07B	121	30.2	8	8, App. 1, Sect. 3, p. 3
Zinc	WJSB-03A	2600	57	4	8, App. 1, Sect. 3, p. 1
	WJSB-05A	1620	57	4	8, App. 1, Sect. 3, pp. 1 and 2
	WJSB-06A	366	57	4	8, App. 1, Sect. 3, pp. 1 and 2
	WJSB-07A	2140	57	4	8, App. 1, Sect. 3, pp. 1 and 2
	WJSB-02B	214	67.7	4	8, App. 1, Sect. 3, p. 3
	WJSB-05B	1160	67.7	4	8, App. 1, Sect. 3, p. 3
	WJSB-06B	433	67.7	4	8, App. 1, Sect. 3, p. 3
	WJSB-07B	686	67.7	4	8, App. 1, Sect. 3, p. 3

NA = Not applicable
ND = The hazardous substance was not detected above the CRQL for organics or the CRDL for inorganics.

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to evaluate Tier A source hazardous waste quantity; therefore, hazardous constituent quantity is not scored (NS).

Hazardous Constituent Quantity Value (S): NS

2.4.2.1.2 Hazardous Wastestream Quantity

The information available is not sufficient to evaluate Tier B source hazardous waste quantity; therefore, hazardous wastestream quantity is not scored (NS).

Hazardous Wastestream Quantity Value (W): NS

2.4.2.1.3 Volume

The information available is not sufficient to evaluate Tier C source hazardous waste quantity; therefore, volume is not scored (NS).

Volume Assigned Value: NS

2.4.2.1.4 Area

Based on aerial photography interpretation, the area of the landfill prior to closure was 32.1 acres or 1,398,276 ft^2 (Ref. 3, p. 2). The Hazardous Waste Quantity (HWQ) value was determined as follows, as stated in Table 2-5 of the HRS (Ref. 1, p. 51591): HWQ = Area of contaminated soil (ft^2) / 34,000 = 1,398,276 / 34,000 = 411.3.

Area of Source ($ft^{2)}$: 1,398,276
Area Assigned Value (Ref. 1, Table 2-5): 411.3

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity value for Source 1 is assigned the value for the area of the landfill.

Source Hazardous Waste Quantity Value: 411.3

Summary of Sources Evaluated

SUMMARY OF SOURCES EVALUATED						
Source No.	Source Name	Source HWQ Value	Source Containment Values			
			Ground Water	Surface Water	Air Gas	Air Particulate
1	Watson Johnson Landfill	411.3	10	10	NS	NS
Sum of HWQ Values:		411.3				

3.0 GROUND WATER MIGRATION PATHWAY

3.0.1 GENERAL CONSIDERATIONS

Aquifer/Stratum 1 (shallowest)

Shallow Aquifers/Stratum Names: Brunswick Group

The site is located within the Triassic Lowland Section of the Peidmont Physiographic Province (Ref. 10, p. 5; Ref. 42). The Piedmont Province is underlain by dense, almost impermeable bedrock that yields water primarily from secondary porosity and permeability provided by fractures (Ref. 10, p. 1; Ref. 42). The Newark Basin contains three principal stratigraphic units; from oldest to youngest, these are the Stockton Formation of Triassic age, which is mainly soft feldspathic sandstone, shale, and some conglomerate with a maximum thickness of 6,000 feet; the Lockatong Formation of Triassic age, which is predominately gray and black siltstone and shale with a maximum thickness of 3,800 feet; and the Brunswick Group of Jurassic and Triassic age, which contains argillite, shale, siltstone, sandstone, conglomerate, and three basalt units with a maximum thickness of 21,000 feet (Ref. 10, p.4; Ref. 11, p. 4). The Brunswick Group is not made up of rocks that typically exhibit karst characteristics (Ref. 10, p. 4). In the Triassic sedimentary rocks that make up the Brunswick Group Aquifer, ground water movement occurs through primary porosity (intergranular openings) in the weathered portion and in the unweathered portion of these rocks, the majority of ground water movement is through secondary porosity features such as fractures, bedding planes, and joints. Ground water flow in Triassic sedimentary rocks is highly anisotropic with the predominant flow direction coincident along bedding strike. Wells of similar depth along strike intersect the same water-bearing zones while wells in a downdip direction with similar depth would not intercept the same water-bearing zone. Measurements of strike and dip of bedding for Bucks County indicate that strike is approximately north 30 degrees east with a dip of 20 degrees northwest in the Quakertown area with some variation as a result of post depositional metamorphism (Ref. 43, pp. 1 and 1a).

According to available databases and home well surveys compiled during the EPA field investigations, the depth of the residential and monitoring wells in the area of the site are between 60 and 500 feet; therefore, the wells are located within the Brunswick Group (Ref. 14; Ref. 32; Ref. 33; Ref. 34). This is confirmed by the observations made during the installation of the monitoring wells. Layers of red-brown shale and light to dark gray shale were observed during the drilling of the monitoring wells. This lithology is typical of the Brunswick Group (Ref. 9, pp. 18 and App. 2; Ref. 12, p. 2).

As detailed in Section 3.3 of this documentation record, ground water obtained from the Brunswick Group is the source of potable water for the population residing within the 4-mile target distance limit around the site.

3.1 Likelihood of Release

3.1.1 Observed Release

Aquifer Being Evaluated: Brunswick Group

Chemical Analysis:

Samples were collected during the 1998 Site Inspection (SI) and 1999 Expanded Site Inspection (ESI) conducted by EPA's SATA team. A comparison of background samples with release samples documents an observed release to the Brunswick Group aquifer. All samples were analyzed according to EPA CLP protocols (Ref. 8, p. 1; Ref. 9, pp. 1 and 2). Residential well samples are designated by "RW", monitoring well samples are designated by "MW"; "S" indicates a shallow well and "D" a deep well. In lieu of the Sample Quantitation Limit, the Contract Required Dectection Limit (CRDL) (for inorganics) or the Contract Required Quantitation Limit (CRQL) (for organics) or is given (Ref. 1, p. 51589, Table 2-3).

Note: Hazardous substances detected in residential wells that were not detected in on-site soils or monitoring wells cannot be definitively attributed to the site at this time and therefore are not shown in the tables below. Arsenic has been included in these tables because it is found at three times background levels and it was also detected in soil samples on-site; however it has not been included in scoring because the arsenic in these wells may be due to the naturally occurring pyrite that is found as part of the geologic materials underlying the site (Ref. 9, p. 18). Studies indicate that sandstone aquifers containing pyrite may cause elevated levels of arsenic in the ground water. With the available data it is not possible to determine if the elevated levels of arsenic shown in the tables below are due to naturally-occurring processes or are site-related (Ref. 21).

Note: The SI and ESI utilized different numbering systems for the residential wells; i.e., RW-10 during the SI may have been a different location than RW-10 during the ESI. Furthermore, a residential well which was sampled during both the SI and ESI may have had different designations. Therefore, all residential well samples are given with an "SI/" or "ESI/" prefix in the following discussion.

A. EPA Site Inspection of September 1998

EPA sampled four monitoring wells and 17 residential wells in September 1998 (Ref. 8, pp. 6 through 8). The background sample and the samples showing an observed release are listed in the following table. SI/RW-08 and SI/RW-09 were duplicate samples from the same well (Ref. 8, p. 7). See Ref. 23 for a map showing approximate well locations. [Note: Ref. 8, Figure 3 also shows some of these well locations, but some of the locations are inaccurate.]

[Table on next page.]

Sample (Location)	Depth (feet)	Date	Hazardous Substances (µg/L) first line: Concentration in Sample second line: {CRDL}			References
			Arsenic	Copper	Manganese	
BACKGROUND SAMPLE						
SI/RW-16 (E. Pumping Stn. Rd.)	133	9/22/98	ND {3}	31.3 {5}	ND {10}	8, p. 8; App. 1, Sect. 2, pp. 2, 13; 23
RELEASE SAMPLES						
SI/RW-02 (Heller Rd.)	120	9/21/98	16.1 {3}			8, p. 7; App. 1, Sect. 2, p. 4; 23; 34, p. 3
SI/RW-03 (Richlandtown Pike)	60	9/21/98	3.1 {3}			8, p. 7; App. 1, Sect. 2, p. 4; 23; 34, p. 5
SI/RW-04 (Richlandtown Pike)	unk.	9/21/98	3 {3}			8, p. 7; App. 1, Sect. 2, p. 4; 23
SI/RW-05 (E. Pumping Stn. Rd.)	unk.	9/21/98	6 {3}			8, p. 7; App. 1, Sect. 2, p. 4; 23
SI/RW-06 (Richlandtown Pike)	65	9/21/98			162 {10}	8, p. 7; App. 1, Sect. 2, p. 4; 23; 34, p. 7
SI/RW-08; SI/RW-09 (E. Pumping Stn. Rd.)	unk.	9/22/98	3.2L; 3.7L {3}; {3}			8, p. 7; App. 1, Sect. 2, p. 4; 23
SI/RW-10 (E. Pumping Stn. Rd.)	200	9/22/98	3.8L {3}			8, p. 7; App. 1, Sect. 2, p. 4; 14, Map ID 5; 23
SI/RW-12 (Richlandtown Pike)	190	9/22/98	33.5 {3}			8, p. 7; App. 1, Sect. 2, p. 4; 23; 34, p. 10
SI/RW-13 (Richlandtown Pike)	unk.	9/22/98		105 {5}		8, p. 7; App. 1, Sect. 2, p. 4; 23
SI/RW-14 (Richlandtown Pike)	unk.	9/22/98	14.6 {3}			8, p. 8; App. 1, Sect. 2, p. 4; 23
SI/RW-15 (Richlandtown Pike)	unk.	9/22/98	3.7L {3}			8, p. 8; App. 1, Sect. 2, p. 4; 23

ND = The substance was not detected above the detection limit.

unk. = The exact depths of these residential wells are unknown; however, available data on residential wells in this area indicate that they typically are 60 to 200 feet deep. The depths of all wells documented in available databases place them within the Brunswick Group, the aquifer evaluated with this HRS scoring package (Ref. 10, p. 4; Ref. 11, p. 4; Ref. 14; Ref. 32; Ref. 34; Ref. 42).

[ ] = Analyte present. As value approaches the Instrument Detection Limit (IDL) the quantitation may not be accurate (Ref. 9, App. 1, p. 1).

L = Analyte present. Reported value may be biased low. Actual value is expected to be higher. Because these are release samples, not background samples, this qualified data has not been adjusted in accordance with the November 1996 EPA fact sheet entitled "Using Qualified Data to Document an Observed Release or Observed Contamination" (Ref. 9, App. 1, p. 1; Ref. 26).

B. EPA Expanded Site Inspection: Residential Well Sampling of July 1999

In the first phase of an Expanded Site Inspection (ESI) in July 1999, EPA sampled 17 residential wells and also obtained a blended sample from two municipal wells (Ref. 9, pp. 10 through 12; Ref. 35, p. 4). See Ref. 23 for a map showing approximate well locations. [Note: Ref. 9, Figure 3 also shows these well locations.]

Well (Location)	Depth (feet)	Date	Hazardous Substances (µg/L) first line: Concentration in Sample second line: {CRDL/CRQL}			References
			Arsenic	TCE	PCE	
BACKGROUND SAMPLE						
ESI/RW-9 (Junction Lane)	unk.	7/12/99	[6.5] {10}	ND {1}	ND {1}	9, p. 11; App. 1, pp. 3, 7; 23
RELEASE SAMPLES						
ESI/RW-18 (Heller Rd.)*	200; 500*	7/13/99		35 {1}	1 {1}	9, p. 12; App. 1, p. 9; 15, p. 5; 35, p. 4; 23; 43
ESI/RW-13 (Richlandtown Pike)	unk.	7/13/99	28.8 {1.5}			9, p. 1; App. 1, p. 5; 23; 35, p. 4
ESI/RW-15 (Richlandtown Pike)	unk.	7/13/99	22.5 {1.5}			9, p. 1; App. 1, p. 5; 23; 35, p. 4

* ESI/RW-18 was a blended sample from Quakertown Municipal Wells QT-10 and QT-17; QT-10 is 200' deep, and QT-17 is 500' deep.

ND = The substance was not detected above the detection limit.
unk. = The exact depths of these residential wells are unknown; however, available data on residential wells in this area indicate that they typically are 60 to 200 feet deep. The depths of all wells documented in available databases place them within the Brunswick Group, the aquifer evaluated with this HRS scoring package (Ref. 10, p. 4; Ref. 11, p. 4; Ref. 14; Ref. 32; Ref. 34; Ref. 42).
[ ] = Analyte present. As value approaches the Instrument Detection Limit (IDL) the quantitation may not be accurate (Ref. 9, App. 1, p. 1).

C. EPA Expanded Site Inspection: Monitoring Well Sampling of September 1999

In a later phase of the ESI, EPA sampled seven monitoring wells in September 1999. A duplicate sample was taken from MW-03S (Ref. 9, pp. 15-16). See Figure 2 of this Documentation Record for a map showing approximate well locations.

Well (Sample ID)	Screened Interval (feet)	Date	Hazardous Substances (µg/L) first line: Concentration in Sample second line: {CRDL/CRQL}						References
			Chro-mium	Manga-nese	Nickel	TCE	PCE	Vinyl Chloride	
BACKGROUND SAMPLES									
MW-01S (R368002)	80-100	9/20/99	7.8B {5}	9.9 {10}	[3.6L] {20}	ND {1}	ND {1}	ND {1}	9, pp. 15, 18; App. 1, pp. 50, 52
MW-01D (R368001)	150-170	9/20/99	14.3 {5}	[2] {10}	[2.8L] {20}	ND {1}	ND {1}	ND {1}	9, pp. 15, 18; App. 1, pp. 50, 52
RELEASE SAMPLES									
MW-03S (R368005)	80-100	9/20/99		92 {10}	32.8 {20}	7.1 {1}	6.9 {1}	7.1 {1}	9, pp. 15, 18; App. 1, pp. 50, 52
(R368008)				115 {10}	30.1 {20}	7.4 {1}	6.4 {1}	7 {1}	9, pp. 16, 18; App. 1, pp. 51, 53
MW-03D (R368004)	150-175	9/20/99	55.1 {5}	42.6 {10}	121 {20}	3.9 {1}	2.6 {1}	2.6 {1}	9, pp. 16, 18; App. 1, p. 50
MW-04S (R368007)	70-90	9/20/99		91.6 {10}	30.1 {20}	1,560 {1}			9, pp. 16, 18; App. 1, pp. 50-52
MW-04D (R368006)	160-180	9/20/99				14.3 {1}	9.9 {1}	10.4 {1}	9, pp. 16, 18; App. 1, pp. 51, 53

ND = The substance was not detected above the detection limit.
B = Not detected substantially above the level reported in the laboratory or field blanks (Ref. 9, App. 1, p. 1).
[ ] = Analyte present. As value approaches the Instrument Detection Limit (IDL) the quantitation may not be accurate (Ref. 9, App. 1, p. 1).
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher. Because these are release samples, not background samples, this qualified data has not been adjusted in accordance with the November 1996 EPA fact sheet entitled "Using Qualified Data to Document an Observed Release or Observed Contamination" (Ref. 9, App. 1, p. 1; Ref. 26).

Attribution:

The Watson Johnson Landfill accepted all wastes generated from Quakertown Borough and portions of Perkasie and Sellersville Boroughs for 37 years (Ref. 5, p. 2; Ref. 6, p. 2). Although the exact types and quantities of wastes accepted at the landfill is not known, an Eckhardt survey completed by W.R. Grace & Company documented that the company disposed of 3,200 tons of chemical waste from their Quakertown chemical facility from 1965 through 1968. This waste was composed of various organic and inorganic compounds, resins, and elastomers (Ref. 25). The drum and surrounding soils containing PCE, that were discovered during the drilling of monitoring wells at the landfill, further documents that hazardous substances were disposed of at the landfill (Ref. 13, p. 5; Ref. 45, pp. 1 through 3 and D-2 through D-11). PCE is known to break down into TCE, which in turn eventually breaks down into vinyl chloride (Ref. 39). Both TCE and vinyl chloride were detected in on-site monitoring wells (Ref. 9, App. 1, pp. 52 and 53). As documented in Section 2.4.1 of this documentation record, analytical results from soil samples collected from the landfill during the ESI indicate contamination with various volatile organic compounds, semi-volatile organic compounds, PCBs, and metals.

Results from monitoring wells installed around the landfill document that in addition to the hazardous substances remaining in the soils at the site, volatile organic compounds have migrated into the ground water in the vicinity of the site (Ref. 9, App. 1, p. 52 and 53). The contaminants (TCE and PCE) detected in RW-18 (blended ground water collected before treatment, from Quakertown Borough Municipal Wells QT-10 and QT-17) were also detected in ground water samples from monitoring wells located around the Watson Johnson Landfill. Based on the analysis of ground water data for the Quakertown area, the observed contamination in the Quakertown wells can be attributed to the Watson Johnson Landfill as follows: ground water flow in the Triassic age sedimentary rocks is highly anisotropic with the predominant flow direction coincident along bedding strike. Wells of similar depth along strike intersect the same water-bearing zones while wells in a downdip direction with similar depths would not intercept the same water-bearing zone. Measurements of strike and dip of bedding for Bucks County indicate that strike is approximately north 30 degrees east with a dip of 20 degrees northwest in the Quakertown area, with some variation as a result of post depositional metamorphism. The Watson Johnson Landfill is located roughly 3,000 feet north-northeast and along strike of the Quakertown Wells 10 and 17 (RW-18). Therefore, the water-bearing zones of the Brunswick Group Aquifer, which underlie the Watson Johnson Landfill, are some of the same water producing zones that Quakertown Wells 10 and 17 pump water from. In addition, results of a pump test completed for a well in the Walnut Bank Farm development, located approximately 0.5 mile southwest of the Watson Johnson Landfill, demonstrated that drawdown effects were observed to the east, along a 2,000 foot stretch of Heller Road. This location would be considered an updip direction of the Walnut Bank pump test well. No drawdown was observed to the west in the downdip direction. The largest drawdown was observed in a well 1,000 feet east-northeast of the test well and in the direction of the Watson Johnson Landfill. This pump test substantiates that water-producing zones exist in the site area over large areas, at least 2,000 feet or greater. In summary, the existing hydrogeologic data indicates that water producing zones exist over large areas within the Brunswick Group Aquifer, with flow occurring mostly along bedding strike. The Quakertown Borough Wells 10 and 17 are along strike of the Watson Johnson Landfill (Ref. 42).

Immediately to the west of the Watson Johnson Landfill is a property which was formerly mined and then later used for waste tile disposal by the American Olean Tile company (Ref. 31, p. 2). This adjacent property may therefore be contaminated with metals and/or other hazardous substances. In this HRS scoring for the Watson Johnson Landfill site, however, all of the hazardous substances documented to be in ground water were detected in elevated levels in the soils of the Watson Johnson Landfill. Therefore,

the release to ground water evaluated in this HRS scoring is at least partially attributable to the Watson Johnson Landfill site.

Hazardous Substances Released:

Chromium
Copper
Manganese
Nickel
Tetrachloroethene (PCE)
Trichloroethene (TCE)
Vinyl Chloride

Ground Water Observed Release Factor Value: 550

3.2 Waste Characteristics

3.2.1 Toxicity/Mobility

Presented below are the hazardous substances documented at Source 1 and/or contained in the observed release to ground water.

Hazardous Substance	Source No.	Toxicity Factor Value	Mobility Factor Value	Toxicity/ Mobility	Reference
Acetone	1	10	1.0	10	2, p. B-1
Acenaphthene	1	10	.01	.01	2, p. B-1
Acenaphthylene	1	NL	1.0	NA	2, p. B-1
Aniline	1	10,000	1.0	10,000	2, p. B-2
Anthracene	1	10	.01	0.1	2, p. B-2
Benzo(a)anthracene	1	1,000	.01	10	2, p. B-2
Benzo(a)pyrene	1	10,000	.0001	1	2, p. B-2
Benzo(b)fluoranthene	1	1,000	.0001	0.1	2, p. B-3
Benzo(g,h,i)perylene	1	NL	.0001	NA	2, p. B-3
Benzo(k)fluoranthene	1	100	.0001	0.01	2, p. B-3
Bromobenzene	1	NL	NL	NA	2, p. B-3
Butylbenzene(n)	1	NL	NL	NA	2, p. B-4
Bis(2-ethylhexyl)phthalate	1	100	.0001	100	2, p. B-3
Butylbenzene(sec-)	1	NL	NL	NA	2, p. B-4
Carbazole	1	10	1	10	2, p. B-4
Chlorobenzene	1	100	1	100	2, p. B-5
Chrysene	1	10	.01	0.1	2, p. B-5
DDD(4,4')	1	100	.0001	0.01	2, p. B-6
Dibenzo(a,h)anthracene	1	10,000	.0001	1	2, p. B-7
Dibenzofuran	1	NL	.01	NA	2, p. B-7
Dichlorobenzene(1,2-)	1	10	1	10	2, p. B-7
Dichlorobenzene(1,4-)	1	10	1	10	2, p. B-7
Dichlorodifluoromethane	1	10	1	10	2, p. B-7
Di-n-butylphthalate	1	NL	NL	NA	2, p. B-9
Ethylbenzene	1	10	1	10	2, p. B-10
Fluoranthene	1	100	.01	1	2, p. B-10
Fluorene	1	100	.01	1	2, p. B-10
Indeno(1,2,3-cd)pyrene	1	1,000	.0001	0.1	2, p. B-12
Isopropylbenzene	1	NL	NL	NA	2, p. B-13

Ground Water – Waste Characteristics

Hazardous Substance	Source No.	Toxicity Factor Value	Mobility Factor Value	Toxicity/ Mobility	Reference
Isopropyltoluene(p-)	1	NL	NL	NA	2, p. B-13
Methylene Chloride	1	10	1	10	2, p. B-14
Methylnaphthalene(2-)	1	NL	.01	NA	2, p. B-14
Naphthalene	1	100	1	100	2, p. B-14
PCBs	1	10,000	.0001	1	2, p. B-16
Phenanthrene	1	NL	.01	NA	2, p. B-16
Phenol	1	1	1	1	2, p. B-16
Propylbenzene(n-)	1	NL	NL	NA	2, p. B-17
Pyrene	1	100	.01	1	2, p. B-17
Tetrachloroethene	1	100	1	100	2, p. B-18
Trichloroethene	1	10	1	10	2, p. B-19
Trimethylbenzene(1,2,4-)	1	NL	NL	NA	2, p. B-20
Vinyl Chloride	1	10,000	1	10,000	2, p. B-20
Xylene (m)	1	1	1	1	2, p. B-20
Xylene (p)	1	10	1	10	2, p. B-20
Xylene (o)	1	1	1	1	2, p. B-20
Chromium	1	10,000	1*	10,000	2, p. B-5
Arsenic	1	10,000	.01	100	2, p. B-2
Copper	1	NL	1*	NA	2, p. B-6
Lead	1	10,000	.01	100	2, p. B-13
Manganese	1	10,000	1*	10,000	2, p. B-13
Mercury	1	10,000	.01	100	2, p. B-13
Nickel	1	10,000	1*	10,000	2, p. B-14
Zinc	1	10	1*	10	2, p. B-20

* = All substances that meet the criteria for an observed release by chemical analysis to an aquifer are assigned a mobility factor of 1 (Ref. 1, Section 3.2.1.2).
NL = Not listed in the Superfund Chemical Data Matrix.
NA = Not applicable.

Toxicity/Mobility Factor Value: 10,000
(Ref. 1, Table 3-9)

3.2.2 Hazardous Waste Quantity

Source Number	Source Hazardous Waste Quantity Value (Section 2.4.2.1.5)	Is source hazardous constituent quantity data adequately determined?
1	411.3	No (see Section 2.4.2.1.1 of this Documentation Record)
Sum	411.3	

According to HRS Table 2-6, the Hazardous Waste Quantity Factor Value is 100 (Ref. 1, p. 51591).

Hazardous Waste Quantity Factor Value: 100

3.2.3 Waste Characteristics Factor Category Value

The waste characteristics for the ground water pathway is calculated below, as specified in the HRS Final Rule (Ref. 1, pp. 51591 and 51602):

Toxicity/Mobility Factor Value = 10,000
HWQ Factor Value = 100
Toxicity/Mobility Factor Value × HWQ Factor Value = 1×10^6

According to HRS Table 2-7, the Waste Characteristics Factor Category Value is 32 (Ref. 1, p. 51592).

Waste Characteristics Factor Category Value: 32

3.3 TARGETS

Actual Contamination (Level I or II Concentrations):

This table lists the wells documented with Level I or II concentrations of hazardous substances. The table also indicates which Ground Water – Observed Release sections in this Documentation Record (see Section 3.1.1) document the Level I or II contamination.

Well	Distance From Source	Aquifer	Level of Contamination	GW Obs. Rel. Section(s)	References
SI/RW-06	0.25 - 0.5 mi	Brunswick Group	Level II (Manganese, 162 µg/L)	A	8, Fig. 3; 23
SI/RW-13	0.5 - 1.0 mi		Level II (Copper, 105 µg/L)	A	8, Fig. 3; 23
ESI/RW-18	0.5 - 1.0 mi		Level I (TCE, 35 ug/L) {also Level II for PCE, 1 ug/L}	B	9, Fig. 3; 23

Note: To determine Level I and II contamination in the above table, concentrations were compared to the following benchmark values (given in μg/L) contained in the Superfund Chemical Data Matrix (Ref. 2):

Risk-Based Benchmark Values	Copper	Manganese	PCE	TCE
Maximum Contaminant Level (MCL)	1,300	—	5	5
Reference Dose Screen Concentration (RDSC)	—	5,100	370	—
Cancer Risk Screen Concentration (CRSC)	—	—	1.6	7.7
Reference (all Ref. 2):	p. B-27	p. B-34	p. B-39	p. B-40

Note: Ten residential wells – SI/RW-2, SI/RW-3, SI/RW-4, SI/RW-5, SI/RW-8, SI/RW-10, SI/RW-12 (same as ESI/RW-13), SI/RW-14, SI/RW-15, and ESI/RW-15 – had levels of arsenic that also document Level I targets. However, the arsenic in these wells may be due to the naturally occurring pyrite that is found as part of the geologic materials underlying the site (Ref. 9, p. 18). Studies indicate that sandstone aquifers containing pyrite may cause elevated levels of arsenic in the ground water (Ref. 21). In addition, currently available analytical results indicate that the on-site monitoring wells have lower arsenic levels than many of these same residential wells (Ref. 8, App. 1, Sect. 2, p. 4; Ref. 9, App. 1, pp. 5, 50, 51, and 53). Thus, currently available evidence indicates that the elevated levels of arsenic found in these residential wells is due to naturally-occurring processes and is not related to the site. Therefore, these wells are not included as Level I targets.

Potential Contamination:

The table below details the municipal water systems that have wells that draw water from the Brunswick Group aquifer within the 4-mile target distance limit (TDL) (Ref. 33). Conflicting data was received from officials concerning the various public water suppliers in the area; therefore, to determine the most conservative score, only those wells whose locations could be verified with current databases were included. According to the 1990 Census Bureau data, there are 2.62 persons per household residing within a 4-mile radius of the site (Ref. 19). See Ref. 23 for a map showing approximate well locations.

Distance From Site	Public Well	Number of Wells	Population Served	References
0 - 0.25 mi	None	0	0	14; 23
0.25 - 0.5 mi	None	0	0	14; 23
0.5 - 1 mi	Quakertown Borough Mun. System[1]	5	5,820	8 (Fig. 3); 14; 15; 16; 23
	Walnut Bank[2]	1	110	18; 19; 22; 23
1 - 2 mi	Quakertown Borough Mun. System[1]	2	2,327	8 (Fig. 3); 14; 16; 17; 23
	Melody Lakes[3]	3	927	18; 19; 22; 23
	Cherry Hill[4]	2	105	18; 19; 22; 23
	Richlandtown[5]	3	1,170	18; 19; 22; 23
2 - 3 mi	Richland Twp. (Richland Court)[6]	1	79	14; 17; 23
	Quakertown Borough Mun. System[1]	3	3,491	8 (Fig. 3); 14; 15; 16; 23
3 - 4 mi	Milford Township[7]	1	720	14; 18; 22; 23

[1] The Quakertown Borough Municipal System has 11 wells that serve 12,804 people (Ref. 15).
[2] Walnut Bank has one well with 42 connections; therefore, this system serves 110 people (Ref. 22).
[3] The Melody Lakes system consists of three wells with 354 connections; therefore, this system serves 927 people (Ref. 22).
[4] The Cherry Hill system consists of 2 wells with 40 connections; therefore, this system serves 105 people (Ref. 22).
[5] The Richlandtown Borough Municipal Water Works system consists of 3 wells that supply 1,170 people (Ref. 13, p. 8).
[6] There are many developments located within Richland Township. Water supply data is available for the Richland Court development. This development has one well that has 30 service connections (Ref. 17). The total population served is therefore 79 persons.
[7] Milford Township has two wells that serve 550 residential connections (Ref. 17); therefore, it is estimated that the one well documented within the 4-mile radius serves 720 people.

In addition to the public supply wells outlined above, there are private residential wells located within the 4-mile TDL. The population served by private wells are documented in the table below.

Radius Distance From Site (Miles)	Population	References
0 - 0.25	40	14; 19
0.25 - 0.5	121	14; 19
0.5 - 1	492	14; 19
1 - 2	1,782	14; 19
2 - 3	3,360	14; 19
3 - 4	6,073	14; 19

3.3.1 Nearest Well

As documented in Section 3.3.2.2, the Quakertown Borough Municipal Well QT-10 / QT-17 (sample ESI/RW-18) is subject to Level I contamination. Therefore, the nearest well factor value is 50 (Ref. 1, Table 3-11).

Nearest Well Factor Value: 50

3.3.2 Population

3.3.2.2 Level I Concentrations

Level I Wells	Population	Reference
ESI/RW-18 (QT-10 and QT-17)	1,164	9, p. 9 and App. 1, p.5; 15;43

The population served by Level I wells is multiplied by 10 to determine the Level I Concentrations Factor Value: 1,164 x 10 = 11,640 (Ref. 1, p. 51603).

Level I Concentrations Factor Value: 11,640

3.3.2.3 Level II Concentrations

Level II Wells	Population*	Reference
SI/RW-6	2.62	8, App. 1, Sect. 2, p. 4; 20
SI/RW-13	2.62	8, App. 1, Sect. 2, p. 4; 20
Total	5.24	

The population values are the average number of persons per residence within a 4-mile radius of the site (Ref. 19). The total population served by Level II wells is multiplied by 1 to determine the Level II Concentrations Factor Value: 5.24 x 1 = 5.24 (Ref. 1, p. 51603).

Level II Concentrations Factor Value : 5.24

3.3.2.4 Potential Contamination

The table below summarizes the population within the 4-mile TDL that rely on public or private wells that have not been counted under Level I or II targets (see Sections 3.3, 3.3.2.2, and 3.3.2.3 of this Documentation Record). The Brunswick Group aquifer is not a karst aquifer (Ref. 10, p. 4).

Radius Distance From Site (Miles)	Total Population	Level I/II Wells		Remaining Population	Distance-weighted population value (Ref. 1, p. 51604, Table 3-12)
		Sample ID(s)	Population		
0 - 0.25	40			40	53
0.25 - 0.5	121	SI/RW-06	2.62	118.38	102
0.5 - 1	6,312	SI/RW-13 ESI/RW-18	1,166.62	5,145.38	1,669
1 - 2	6,311			6,311	939
2 - 3	6,930			6,930	678
3 - 4	6,793			6,793	417
Total	26,507		1,169.24	25,337.76	3,858

The sum of the distance-weighted population values is multiplied by 0.1, and the result is rounded to the nearest integer, to determine the Potential Contamination Factor Value (Ref. 1, p. 51604). Therefore, the Potential Contamination Factor Value is: 3,858 x 0.1 = 386.

Potential Contamination Factor Value: 386

3.3.3 Resources

No resource uses have been identified in the study area. Therefore, a value of 0 is assigned (Ref. 1, Section 3.3.3).

Resource Factor Value: 0

3.3.4 Wellhead Protection Area

Analysis of a ground water sample collected from the blended Quakertown Borough Municipal Wells (QT-10 and QT-17) revealed hazardous substances attributable to the site (TCE and PCE). In accordance with Title 25 of the Pennsylvania Code (Chapter 109), this municipal well is within a delineated wellhead protection area (Zone I); therefore, a value of 20 is assigned (Ref. 1, p. 51604; Ref. 20, p. 13).

Wellhead Protection Area Factor Value: 20

4.0 SURFACE WATER MIGRATION PATHWAY

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

The site is located within one watershed. Overland flow from the site enters a wetland that is adjacent to the landfill's southwestern boundary. Surface water flows through this wetland and eventually discharges to the Tohickon Creek (Ref. 28; Ref. 29). The Tohickon Creek flows from the north near the site's western boundary and continues past the site in a southeasterly direction (Ref. 24).

4.1.1.1 DEFINITION OF THE HAZARDOUS SUBSTANCE MIGRATION PATH FOR OVERLAND/FLOOD COMPONENT

According to historical inspections as well as recent observations, the probable point of entry (PPE) of hazardous substances released from Source 1 is a wetland area located adjacent to the southwestern edge of the landfill (Ref. 4; Ref. 5, pp. 2 and 3; Ref. 13, p. 9; Ref. 29). This wetland area discharges into the Tohickon Creek at its southwestern edge 1,000 feet from the PPE (Ref. 13, p. 9; Ref. 29; Ref. 24). The Tohickon Creek flows in a south/southeasterly direction for the remainder of the 15-mile TDL (Ref. 24).

Sediment and surface water samples were collected along the surface water pathway during the SI and ESI. Three sediment samples were collected during the SI in the wetland area that receives drainage from the landfill (Ref. 8, pp. 9,10, and App. 2, Figure 2). As documented in Section 4.1.2.1 of this documentation record, these samples document that this wetland area has been impacted by hazardous substances released from the site. Sediment and surface water samples were collected from the Tohickon Creek during the ESI (Ref. 9, pp. 12 and 13). Analytical results for these samples show hazardous substances have also been released from the site to the Tohickon Creek (Ref. 9, App. 1, Sect. 4, pp. 13 and 17).

Downstream Segment Lengths

Segment ID	Segment Description	Approximate Segment Length (ft/mile)	Cumulative Length (ft/mile)
1	PPE in adjacent wetland area to discharge point in Tohickon Creek	1,000 / 0.19	1,000 / 0.19
2	Tohickon Creek	78,196.8 / 14.81	79,196.8 / 15

4.1.2.1 Likelihood of Release

4.1.2.1.1 Observed Release – Tohickon Creek

Chemical Analysis – Surface Water

Surface water samples were collected during the ESI from the Tohickon Creek. A background surface water sample (SW-01) was collected in Tohickon Creek upstream of the point where the wetland discharges into the Tohickon and approximately 50 feet downstream of a discharge pipe that drains the property formerly used by the American Olean Tile company for tile disposal (Ref. 9, pp. 12, 22, and Figure 4; Ref. 31, p. 2; Ref. 35, p. 2). Hazardous substance concentrations in downstream samples SW-05 and SW-02 meeting the HRS observed release criteria are shown below. All samples analyzed during the ESI were analyzed according to EPA CLP protocols (Ref. 9, pp. 1 and 2). In lieu of the Sample Quantitation Limit, the Contract Required Dectection Limit (CRDL) is given (Ref. 1, p. 51589, Table 2-3).

Sample ID / Location	Date	Hazardous Substances (µg/L) first line: Concentration in Sample second line: {CRDL}			References
		Lead	Manganese	Zinc	
BACKGROUND SAMPLE					
SW-01 (upstream of site in Tohickon Creek)	8/16/99	ND {3}	46.1 {15}	ND {20}	Ref. 9, p. 12; App. 1, p. 30; Figure 4
RELEASE SAMPLES					
SW-05 (at PPE of site into adjacent wetland)	8/16/99	4.5K (3.44) {3}	1,620 {15}	54.2 {20}	9, p. 13; App. 1, pp. 1 and 30; Figure 4
SW-02 (Tohickon Creek, 1,056 feet downstream of PPE)	8/16/88	5K (3.82) {3}		26.8 {20}	9, p. 13; App. 1, pp. 1 and 30; Figure 4; 13, p. 11

ND = The substance was not detected above the detection limit.

K = Analyte present. Reported value may be biased high. Actual value is expected to be lower. This qualified data has been adjusted in accordance with the November 1996 EPA fact sheet entitled "Using Qualified Data to Document an Observed Release or Observed Contamination." The adjusted value is shown in parentheses (Ref. 9, App. 1, p. 1; Ref. 26).

Chemical Analysis – Sediment

Sediment samples were collected during the SI and ESI from the wetland that receives drainage from the site, and from the Tohickon Creek. Background sediment samples were collected during the SI and ESI. During the SI a background sediment sample (WJSD-08) was collected from a wetland area outside the influence of the site (Ref. 8, pp. 10 and App. 2, Figure 2; Ref. 40, p. 5). The background sediment collected during the ESI (SD-01) was collected in the Tohickon Creek upstream of the influence of the site and approximately 50 feet downstream of a discharge pipe that drains the property formerly used by the American Olean Tile company for tile disposal (Ref. 9, pp. 12, 22, and Figure 4; Ref. 35, p. 2). Hazardous substance concentrations in downstream samples WJSD-02, WJSD-04, and SD-05 meeting the HRS observed release criteria are shown below. All samples analyzed during the SI and ESI were analyzed according to EPA CLP protocols (Ref. 8, p. 1; Ref. 9, pp. 1 and 2). In lieu of the Sample Quantitation Limit, the Contract Required Dectection Limit (CRDL) (for inorganics) or the Contract Required Quantitation Limit (CRQL) (for organics) or is given (Ref. 1, p. 51589, Table 2-3).

Sample ID (Location)	Depth	Date	Hazardous Substances (mg/kg) first line: Conc. in Sample second line: {CRDL/CRQL}			References
			Lead	Mercury	Aroclor 1254	
BACKGROUND SAMPLES						
WJSD-08 (wetland)	0-2 feet	11/18/98		ND {0.2}	ND {0.033}	8, p. 10; App. 1, Sect. 4, pp. 3, 14; App. 2, Figure 2
SD-01 (upstream of site in Tohickon Creek)	0-3 inches	8/16/99	11.3L (16.27) {0.6}			9, p. 12; App. 1, p. 17; Figure 4
RELEASE SAMPLES						
WJSD-02 (wetland adjacent to site)	0-2 feet	11/18/98		0.3 {0.2}		8, p. 9; App. 1, Sect. 4, p. 1; App. 2, Figure 2
WJSD-04 (wetland adjacent to site)	0-2 feet	11/18/98			0.25 {0.033}	8, p. 9; App. 1, Sect. 4, p. 13; App. 2, Figure 2
SD-05 (wetland adjacent to site at PPE)	0-3 inches	8/16/99	63.5L {0.6}			9, p. 13; App. 1, p, 17; Figure 4

L = Analyte present. Reported value may be biased low. Actual value is expected to be higher. This qualified data has been adjusted as directed in the November 1996 EPA fact sheet entitled "Using Qualified Data to Document an Observed Release or Observed Contamination" (Ref. 9, App. 1, p. 1; Ref. 26).

Attribution:

The hazardous substances elevated above comparable background levels in the wetland sediments and downstream Tohickon Creek surface water and sediment samples were also detected in soil samples collected from Source 1. There was no containment of overland flow at the time the landfill was active and leachate was historically pumped from leachate ponds located in the southern portion of the landfill into the adjacent wetland area (Ref. 4; Ref. 5; Ref. 7). The site was issued an order from PADER in 1973 due to this illegal discharge of leachate into adjacent surface waters (Ref. 7). This leachate discharge from the site was also determined to be the cause of a large fish kill that occurred on July 2 and 3, 1972 in the Tohickon Creek (Ref. 5). The Eckhardt survey completed in 1979 documents that waste accepted at the uncontained Watson Johnson Landfill included organics, inorganics, and miscellaneous waste material co-disposed with municipal waste (Ref. 25).

Immediately to the west of the Watson Johnson Landfill is a property which was formerly mined and then later used for waste tile disposal by the American Olean Tile company (Ref. 31, p. 2). This adjacent property may therefore be contaminated with metals and/or other hazardous substances. Surface water runoff and ground water are collected from this mine area and pumped into sedimentation ponds prior to discharge to the Tohickon Creek (Ref. 31, p. 2). The background surface water and sediment samples (SW-01, SD-01) collected during the Watson Johnson Landfill ESI were collected approximately 50 feet downstream from this discharge point to account for the possible impact of this adjacent property on the creek (Ref. 35, p. 2). Therefore, the observed release to surface water documented in this HRS scoring is attributable to the Watson Johnson Landfill site.

Hazardous Substances Released:

Lead
Manganese
Mercury
PCB
Zinc

Surface Water Observed Release Factor Value: 550

4.1.2.3 Drinking Water Targets

There are no drinking water intakes located along the 15-mile TDL (Ref. 27). Therefore, the drinking water targets section is not included. All factors receive a value of 0.

Nearest Intake Factor Value: 0
Level I Concentrations Factor Value: 0
Level II Concentrations Factor Value: 0
Potential Contamination Factor Value: 0
Resources Factor Value: 0

4.1.3.2 Waste Characteristics

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

Presented below are the combined toxicity/persistence factor values, the human food chain bioaccumulation factor value, and the combined toxicity/persistence/bioaccumulation factor values for all hazardous substances associated with Source 1 and/or contained in the observed release (OR) to surface water.

Hazardous Substance	Source No. and/or OR	Toxicity Factor Value	Persistence Factor Value	Toxicity/ Persistence Factor Value	Human Food Chain Bioaccum. Value	Toxicity/ Persistence/ Bioaccum. Factor Value	Ref.
ORGANICS							
Acetone	1	10	0.4	4	0.5	2	2, p. B-1
Acenaphthylene	1	NL	0.4	NA	500	NA	2, p. B-1
Acenaphthene	1	10	0.4	4	500	2,000	2, p. B-1
Aniline	1	10,000	1.0	10,000	5	$5x10^4$	2, p. B-2
Anthracene	1	10	1.0	10	5,000	$5x10^4$	2, p. B-2
Benzo(a)anthracene	1	1,000	1.0	1,000	50,000	$5x10^7$	2, p. B-2
Benzo(a)pyrene	1	10,000	1.0	10,000	50,000	$5x10^8$	2, p. B-2
Benzo(b)fluoranthene	1	1,000	1.0	1,000	50,000	$5x10^7$	2, p. B-3
Benzo(g,h,i)perylene	1	NL	1.0	NA	50,000	NA	2, p. B-3
Benzo(k)fluoranthene	1	100	1.0	100	50,000	$5x10^6$	2, p. B-3
Bromobenzene	1	NL	NL	NA	NL	NA	2, p. B-3
Butylbenzene(n)	1	NL	NL	NA	NL	NA	2, p. B-4
Bis(2-ethylhexyl)phthalate	1	100	1.0	100	50,000	$5x10^6$	2, p. B-3
Butylbenzene(sec-)	1	NL	NL	NA	NL	NA	2, p. B-4
Carbazole	1	10	0.4	4	500	2000	2, p. B-4
Chlorobenzene	1	100	1.0	100	50	5000	2, p. B-5
Chrysene	1	10	1.0	10	500	500	2, p. B-5
DDD(4,4')	1	100	1.0	100	50,000	$5x10^6$	2, p. B-6
Dibenzo(a,h)anthrancene	1	10,000	1.0	10,000	50,000	$5x10^8$	2, p. B-7
Dibenzofuran	1	NL	1.0	NA	500	NA	2, p. B-7
Dichlorobenzene(1,2-)	1	10	0.4	4	50	200	2, p. B-7
Dichlorobenzene(1,4-)	1	10	0.4	4	50	200	2, p. B-7
Dichlorodifluoromethane	1	100	0.4	40	50	2000	2, p. B-7
Di-n-butylphthalate	1	10	NL	NA	NL	NA	2, p. B-9
Ethylbenzene	1	10	0.4	4	50	200	2, p. B-10
Fluoranthene	1	100	1.0	100	5000	$5x10^5$	2, p. B-10

Hazardous Substance	Source No. and/or OR	Toxicity Factor Value	Persistence Factor Value	Toxicity/ Persistence Factor Value	Human Food Chain Bioaccum. Value	Toxicity/ Persistence/ Bioaccum. Factor Value	Ref.
Fluorene	1	100	1.0	100	5,000	$5x10^5$	2, p. B-10
Indeno(1,2,3-cd)pyrene	1	1,000	1.0	1,000	50,000	$5x10^7$	2, p. B-12
Isopropylbenzene	1	NL	NL	NA	NL	NA	2, p. B-13
Isopropyltoluene(p-)	1	NL	NL	NA	NL	NA	2, p. B-13
Methylene Chloride	1	10	0.4	4	5.0	20	2, p. B-14
Methylnaphthalene(2-)	1	NL	0.4	NA	5,000	NA	2, p. B-14
Naphthalene	1	100	0.4	40	500	$2x10^4$	2, p. B-14
PCB	1, OR	10,000	1.0	10,000	50,000	$5x10^8$	2, p. B-14
Phenanthrene	1	NL	NL	NA	50	NA	2, p. B-16
Phenol	1	1	1.0	1	5	5	2, p. B-16
Propylbenzene(n-)	1	NL	NL	NA	NL	NA	2, p. B-16
Pyrene	1	100	1.0	100	50	5000	2, p. B-17
Tetrachloroethene	1	100	1.0	100	50	5000	2, p. B-18
Trimethylbenzene(1,2,4-)	1	NL	NL	NA	NL	NA	2, p. B-20
Xylene(m)	1	1	0.4	0.4	500	200	2, p. B-20
Xylene(p)	1	10	0.4	4	50	200	2, p. B-20
Xylene(o)	1	1	0.4	0.4	50	20	2, p. B-20
INORGANICS							
Aluminum	1	1	1.0	1	50	50	2, p. B-1
Chromium	1	10,000	1.0	10000	5.0	5×10^4	2, p. B-5
Copper	1	NL	1.0	NA	50000	NA	2, p. B-6
Lead	1, OR	10,000	1.0	10,000	50	5×10^5	2, p. B-13
Manganese	1, OR	10,000	1.0	10,000	0.5	5,000	2, p. B-13
Mercury	1, OR	10,000	4	4,000	50,000	2×10^8	2, p. B-13
Nickel	1	10,000	1.0	10,000	0.5	5,000	2, p. B-14
Zinc	1, OR	10	1.0	10	500	5,000	2, p. B-20

NL = Not Listed
NA = Not Applicable

Toxicity/Persistence/Bioaccumulation Factor Value: $5x10^8$

4.1.3.2.2 Hazardous Waste Quantity

Source Number	Source Hazardous Waste Quantity Value (Section 2.4.2.1.5)	Is source hazardous constituent quantity data adequately determined?
1	411.3	No (see Section 2.4.2.1.1 of this Documentation Record)
Sum	411.3	

According to HRS Table 2-6, the Hazardous Waste Quantity Factor Value is 100 (Ref. 1, p. 51591).

Hazardous Waste Quantity Factor Value: 100

4.1.3.2.3 Waste Characteristics Factor Category Value

The waste characteristics factor value for the Human Food Chain Threat is calculated below, as specified in the HRS Final Rule (Ref. 1, Section 4.1.3.2.3, p. 51620):

Toxicity/Persistence Factor Value = 10,000
HWQ Factor Value = 100
Bioaccumulation Potential Factor Value = 50,000

(Toxicity/Persistence x HWQ) = (10,000 x 100) = $1x10^6$
(Toxicity/Persistence x HWQ) x (Bioaccumulation Potential Factor Value) = (1×10^6) x (50,000) = $5x10^{10}$

According to HRS Table 2-7, the Waste Characteristics Factor Category Value is 320 (Ref. 1, p. 51592).

Waste Characteristics Factor Category Value: 320

4.1.3.3 Human Food Chain Threat – Targets

Actual Contamination of the Human Food Chain

The Tohickon Creek is designated by the PA Department of Environmental Protection (PADEP) as a cold-water fishery along the entire 15-mile TDL (Ref. 27). Actual contamination of the Tohickon Creek fishery is documented by the sample presented below. This sample was collected in the Tohickon Creek 125 downstream of the discharge point of the wetland into Tohickon Creek (Ref. 9, p. 13). Mercury was also detected in a sediment sample (SD-02) that was collected downstream of the site in the Tohickon Creek; however, the concentration was "B" qualified (not detected substantially above the level reported in the laboratory or field blanks) and therefore could not be used to document actual contamination of the fishery (Ref. 9, App. 1, p. 17). Mercury was also detected in on-site soils (as documented in Section 2.4.1 of this HRS documentation record) and in the wetland that receives drainage from the site and discharges into the Tohickon (as documented in Section 4.1.4.3.1.2 of this HRS documentation record).

Sample ID / Sample Location	Hazardous Substance	Sample Concentration (µg/L)	Upstream Concentration (SW-01)	CRDL (µg/L)	Bioaccum-ulation Value
SW-02 (Tohickon Creek, 125 feet downstream of where wetland discharges into creek)	Zinc	26.8	ND	20	500

ND = Not detected

Closed Fisheries

No closed fisheries have been established within the target distance limit.

Level I Concentrations

No Level I concentrations have been established.

Most Distant Level II Sample

Sample ID: SW-02
Distance from wetland discharge point into Tohickon Creek: 125 feet
Reference: 9, p. 13

Level II Fisheries

A hazardous substance that has a bioaccumulation potential factor value of 500 or greater was detected in a surface water sample from the Tohickon Creek fishery. The extent of Level II fisheries is measured from the distance of the wetland discharge point in Tohickon Creek to the location where SW-02 was collected. This distance is measured to be 125 feet (Ref. 9, p. 13).

4.1.3.3.1 Food Chain Individual

A food chain individual factor value of 45 is assigned because there is an observed release of a hazardous substance (zinc) having a bioaccumulation factor value of 500 or greater to the watershed (Ref. 1, p. 51620).

Food Chain Individual Factor Value: 45

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

No Level I concentrations can be documented with the available data.

Level I Concentrations Factor Value: 0

4.1.3.3.2.2 Level II Concentrations

The Tohickon Creek is a fishery that has been documented to be subject to Level II concentrations. The actual production values are not known; therefore, a minimum production value of greater than 0 - 100 is assigned from HRS Table 4-13 (Ref. 1, p. 51621).

Level II Concentrations Factor Value: 0.03

4.1.3.3.2.3 Potential Human Food Chain Contamination

The entire Tohickon Creek is a designated fishery; however, production values are not known. Therefore, a minimum production value is assigned from HRS Table 4-18 (Ref. 1, p. 51621). The flow rate for the Tohickon Creek is unavailable. The Tohickon Creek was observed to be a moderate to large stream during the field investigations; therefore, as provided in Table 4-13 of the HRS Final Rule, a dilution weight of 0.01 is assigned (Ref. 38).

The potential human food chain contamination factor value (PHFC) is calculated as follows:
PHFC = [(P x D)/10], where:

P = Value assigned for human food chain population value from HRS Table 4-18 (Ref. 1, p. 51621); and
D = Dilution weight assigned from HRS Table 4-13 (Ref. 1, p. 51613).

Therefore, PHFC = [(0.03 x 0.01)/10] = 0.00003.

Potential Human Food Chain Contamination Factor Value: 0.00003

4.1.4 ENVIRONMENTAL THREAT

4.1.4.2 Waste Characteristics

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

Summarized below are the hazardous substances that have been documented at Source 1 and/or contained in the observed release (OR) to surface water. The ecosystem bioaccumulation factor values were obtained from the SCDM (Ref. 2). The ecosystem toxicity/persistence/bioaccumulation factor value was obtained from HRS Table 4-21 (Ref. 1, p. 51623).

Hazardous Substance	Source No. and/or OR	Eco-system Toxicity	Persistence Factor Value	Ecosystem Bioaccum.	Ecosystem Toxicity/ Persistence Factor Value	Ecosystem Toxicity/ Persistence/ Bioaccum. Factor Value	Ref.
ORGANICS							
Acetone	1	100	0.4	0.5	40	20	2, p. B-1
Acenaphthylene	1	NL	0.4	500	NL	NA	2, p. B-1
Acenaphthene	1	10,000	0.4	500	4,000	$2x10^6$	2, p. B-1
Aniline	1	10,000	1.0	500	10,000	$5x10^6$	2, p. B-2
Anthracene	1	10,000	1.0	5,000	10,000	$5x10^7$	2, p. B-2
Benzo(a)anthracene	1	10,000	1.0	50,000	10,000	$5x10^8$	2, p. B-2
Benzo(a)pyrene	1	10,000	1.0	50,000	10,000	$5x10^8$	2, p. B-2
Benzo(b)fluoranthene	1	NL	1.0	50,000	NL	NA	2, p. B-3
Benzo(g,h,i)perylene	1	NL	1.0	50,000	NL	NA	2, p. B-3
Benzo(k)fluoranthene	1	NL	1.0	50,000	NL	NA	2, p. B-3
Bromobenzene	1	NL	NL	NL	NL	NA	2, p. B-3
Butylbenzene(n)	1	NL	NL	NL	NL	NA	2, p. B-4
Bis(2-ethylhexyl)phthalate	1	1,000	1.0	50,000	1000	$5x10^7$	2, p. B-3
Butylbenzene(sec-)	1	NL	NL	NL	NL	NA	2, p. B-4
Carbazole	1	NL	0.4	500	NL	NA	2, p. B-4
Chlorobenzene	1	1,000	1.0	50	1,000	$5x10^4$	2, p. B-5
Chrysene	1	1,000	1.0	5000	1,000	$5x10^6$	2, p. B-5
DDD(4,4')	1	10,000	1.0	50,000	10,000	$5x10^8$	2, p. B-6
Dibenzo(a,h)anthrancene	1	NL	1.0	50,000	NL	NA	2, p. B-7
Dibenzofuran	1	100	NL	500	100	$5x10^4$	2, p. B-7
Dichlorobenzene(1,2-)	1	100	0.4	50	40	2000	2, p. B-7
Dichlorobenzene(1,4-)	1	100	0.4	50	40	2000	2, p. B-7
Dichlorodifluoromethane	1	NL	0.4	50	NL	NA	2, p. B-7
Di-n-butylphthalate	1	NL	NL	NL	NL	NA	2, p. B-9

Hazardous Substance	Source No. and/or OR	Eco-system Toxicity	Persistence Factor Value	Ecosystem Bioaccum.	Ecosystem Toxicity/ Persistence Factor Value	Ecosystem Toxicity/ Persistence/ Bioaccum. Factor Value	Ref.
Ethylbenzene	1	100	0.4	50	40	2000	2, p. B-10
Fluoranthene	1	10,000	1.0	500	10,000	$5x10^6$	2, p. B-10
Fluorene	1	1,000	1.0	5,000	1,000	$5x10^6$	2, p. B-10
Indeno(1,2,3-cd)pyrene	1	NL	1.0	50,000	NL	NA	2, p. B-12
Isopropylbenzene	1	NL	NL	NL	NL	NA	2, p. B-13
Isopropyltoluene(p-)	1	NL	NL	NL	NL	NA	2, p. B-13
Methylene Chloride	1	1	0.4	5.0	0.4	2	2, p. B-14
Methylnaphthalene(2-)	1	1,000	NL	5000	400	$2x10^6$	2, p. B-14
Naphthalene	1	1,000	0.4	500	400	$2x10^5$	2, p. B-14
PCB	1, OR	10,000	1.0	50000	10,000	$5x10^8$	2, p. B-14
Phenanthrene	1	1,000	NL	5000	NL	NA	2, p. B-16
Phenol	1	10,000	1.0	5	10,000	$5x10^4$	2, p. B-16
Propylbenzene(n-)	1	NL	NL	NL	NL	NA	2, p. B-16
Pyrene	1	10,000	1.0	50	10,000	$5x10^5$	2, p. B-17
Tetrachloroethene	1	100	0.4	5000	40	$2x10^5$	2, p. B-18
Trimethylbenzene(1,2,4-)	1	NL	NL	NL	NL	NA	2, p. B-19
Xylene(m)	1	100	0.4	50	40	2000	2, p. B-20
Xylene(p)	1	100	0.4	50	40	2000	2, p. B-20
Xylene(o)	1	100	0.4	50	40	2000	2, p. B-20
INORGANICS							
Arsenic	1	10	1.0	500	10	5000	2, p. B-2
Chromium	1	100	1.0	5	100	$5x10^4$	2, p. B-5
Copper	1	100	1.0	50000	100	$5x10^6$	2, p. B-6
Lead	1, OR	1,000	1.0	5000	1000	5×10^6	2, p. B-13
Manganese	1, OR	NL	1.0	50000	NL	NA	2, p. B-13
Mercury	1, OR	10,000	4	50000	4000	2×10^8	2, p. B-13
Nickel	1	10	1.0	500	10	5,000	2, p. B-14
Zinc	1, OR	10	1.0	500	10	5,000	2, p. B-20

Ecosystem Toxicity/Persistence/Bioaccumulation Potential Factor Value: $5x10^8$

4.1.4.2.2 Hazardous Waste Quantity

Source Number	Source Hazardous Waste Quantity Value (Section 2.4.2.1.5)	Is source hazardous constituent quantity data adequately determined?
1	411.3	No (see Section 2.4.2.1.1 of this Documentation Record)
Sum	411.3	

The surface water migration pathway receives runoff from Source 1. According to HRS Table 2-6, the Hazardous Waste Quantity Factor Value is 100 (Ref. 1, p. 51591).

Hazardous Waste Quantity Factor Value: 100

4.1.4.2.3 Waste Characteristics Factor Category Value

A waste characteristics product is calculated by multiplying the ecosystem toxicity/persistence factor value by the hazardous waste quantity factor value. The product (subject to a maximum of $1x10^{6}$) is multiplied by the ecosystem bioaccumulation potential factor value. That product (subject to a maximum product of $1x10^{12}$) is then entered into HRS Table 2-7 (Ref. 1, p. 51592) to obtain the environmental threat waste characterization factor category value. The calculations are presented below.

Ecosystem Toxicity/Persistence Value = 10,000
Ecosystem Bioaccumulation Potential Factor Value = 50,000
HWQ Factor Value = 100
Ecosystem Toxicity/Persistence x HWQ = $1x10^{6}$

(Ecosystem Toxicity/Persistence x HWQ) x (Ecosystem Bioaccumulation Potential Factor Value) = $5x10^{10}$

According to HRS Table 2-7, the Waste Characteristics Factor Category Value is 320 (Ref. 1, p. 51592).

Waste Characteristics Factor Category Value: 320

4.1.4.3 Environmental Threat – Targets

According to historical inspections as well as recent observations, the probable point of entry (PPE) of hazardous substances released from Source 1 is a wetland area located adjacent to the southwestern edge of the landfill (Ref. 4; Ref. 5, pp. 2 and 3; Ref. 13, p. 9; Ref. 29). This wetland area discharges into the Tohickon Creek at its southwestern edge approximately 1,000 feet from the PPE (Ref. 13, p. 9; Ref. 29). Additional wetlands are located along the Tohickon Creek throughout the entire 15-mile TDL (Ref. 28). No other sensitive environments have been identified along the 15-mile TDL.

4.1.4.3.1 Sensitive Environments

4.1.4.3.1.1 Level I Concentrations

No Level I concentrations of sensitive environments have been documented within the 15-mile TDL.

Level I Concentrations Factor Value: 0

4.1.4.3.1.2 Level II Concentrations

The following sediment samples collected during the SI and ESI document elevated levels of hazardous substances in the wetland area that receives drainage from the site. Sample SD-05 was collected at the PPE for Source 1 (Ref. 9, p. 13). Sediment samples WJSD-04 and WJSD-02 were collected during the SI within the wetland area that receives drainage from the site (Ref. 8, p. 9; Ref. 40, pp. 3 and 4). The sample WJSD-02 was collected nearest the point where surface water from the wetland area discharges into the Tohickon Creek (Ref. 40, pp. 3 and 4).

Sample ID (Location)	Hazardous Substance	Concentration (mg/kg)	Reference
SD-05 (wetland adjacent to site at PPE)	Lead	63.5L	9, p. 13; App. 1, p. 17, and Figure 4
WJSD-04 (wetland adjacent to site)	Aroclor-1254 (PCB)	0.25	8, p. 9; App. 1, Sect. 4, p. 1 and App. 2, Figure 2
WJSD-02 (wetland adjacent to site)	Mercury	0.3	8, p. 9; App. 1, Sect. 4, p. 1 and App. 2, Figure 2

L = Analyte present. Reported value may be biased low. Actual value is expected to be higher. Because these are release samples, not background samples, this qualified data was not adjusted as directed in the November 1996 EPA fact sheet entitled "Using Qualified Data to Document an Observed Release or Observed Contamination" (Ref. 26).

The total length of wetlands frontage subject to Level II concentrations is the length from the PPE in the adjacent wetland to the point of discharge of this wetland area into the Tohickon Creek. This length was calculated during the ESI sampling event as 2,112 feet (Ref. 13, p. 11). The wetlands rating value of 25 is assigned from Ref. 1, Table 4-24, p. 51625.

Level II Concentrations Factor Value: 25

4.1.4.3.1.3 Potential Contamination

Wetlands

Documented wetlands occur along the entire 15-mile TDL. The total length of wetlands along the Tohickon Creek, as determined from National Wetland Inventory maps, subject to potential contamination, is approximately 3.84 miles (Ref. 28). There are no pumping stations along the Tohickon Creek; therefore the flow rate for the Tohickon Creek is unavailable. The Tohickon Creek was visually observed to be a moderate to large stream (100 to 1,000 cubic feet per second) during the field investigations; therefore, as provided in Table 4-13 of the HRS Final Rule a dilution weight of 0.01 is assigned (Ref. 38).

The potential contamination factor value (SP) is calculated as follows: SP = (W + S)(D)/10, where:

W = Value assigned for wetlands from HRS Table 4-24.
S = Value assigned for the sensitive environment from HRS Table 4-23.
D = Dilution weight assigned from HRS Table 4-13.

Therefore, SP = (100 + 0)(.01)/10 = 0.1

Potential Contamination Factor Value (SP): 0.1

End of HRS Documentation Record for Watson Johnson Landfill Site
(cover sheet plus 50 pages)